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IN THE

Supreme Court of the United States

OCTOBER TERM, 1985

EDWIN W. EDWARDS, in his Official Capacity as Governor of Louisiana, WILLIAM J. GUSTE, JR., in his Official Capacity as Attorney General of Louisiana, LOUISIANA DEPARTMENT OF EDUCATION, and THOMAS G. CLAUSEN, in his Official Capacity as Superintendent of Education of Louisiana,

Appellants,

v.

DON AGUILLARD *et al.*,

Appellees.

ON APPEAL FROM THE UNITED STATES COURT OF APPEALS FOR THE FIFTH CIRCUIT

JOINT APPENDIX
VOLUME 4

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(2) Noncompelling Status of Cosmic Evolution (of the Universe)

> I have little hesitation in saying that as a result a sickly pall now hangs over the big bang theory. As I have mentioned earlier, when a pattern of facts becomes set against a theory, experience shows that it rarely recovers. Jayant Narlikar, an Indian professor of cosmology, is a leading theoretical physicist who also shares this view.654/
>
> -- Astronomer Sir Fred Hoyle

Cosmic evolution is summarized by Carl Sagan* (an ACLU expert witness) as follows in his best-selling book, Cosmos:

> The epic of cosmic evolution had begun, a hierarchy in the condensation of matter from the gas of the big bang--clusters of galaxies, galaxies, stars, planets, and eventually, life and an intelligence 655/

"Cosmic evolution" (or "stellar evolution") is generally recognized as part of evolution,656/ and is a generally accepted sci-

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654. F. Hoyle, The Intelligent Universe 186 (1983).

655. C. Sagan*, Cosmos 247 (1980).

656. Leading evolutionists Dobzhansky*, Ayala*, Stebbins* and Valentine*

entific term,657/ although the ACLU as a

write:

> During the century and more since Darwinism came into being, the concept of evolution has been applied not only to the living world but to the non-biological as well. Thus, we speak of the evolution of the entire universe, the solar system, and the physical earth . . ..

T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 9 (1977) (chapter 11 is entitled "Cosmic Evolution and the Origin of Life"). Dobzhansky* similarly writes:

> Cosmic Evolution. Discoveries made in various branches of science during the nineteenth and twentieth centuries have converged to establish an evolutionary approach to the understanding of nature. The universe has not always been as it is now. Nature as we observe it today is the outcome of a historical process of development, evolution.

T. Dobzhansky*, Evolution, Genetics, and Man 1 (1955). Accord, Mayr*, Evolution, Scientific American, Sept. 1978, at 47, 47, 51 ("Cosmic evolution and biological evolution have that much in common."); H. Blum*, Time's Arrow and Evolution 4 (3d ed. 1968) ("Most works dealing with organic evolution focus attention on its strictly biological aspects, disregarding to a great extent those physical factors that have determined the basic pattern along which living systems could subsequently develop. To understand these factors and restrictions, one needs to go back to the origin of life, and be-

matter of tactics is denying this.658/ For

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yond into the domains of terrestrial and cosmic evolution.") Huxley*, At Random, in 3 Evolution after Darwin 41-65 (S. Tax ed. 1960), ("it is evolution, in the broad sense, that links inorganic nature with life, and the stars with earth, and matter with mind, and animals with man."); E. Olson* & J. Robinson*, Concepts of Evolution 10 (1975) ("Evolutionism is the doctrine that the universe, including inorganic and organic matter in all its manifestations, is the product of gradual and progressive development."); Wilson*, The Origin of Life, in Did the Devil Make Darwin Do It? ___, ____ (D. Wilson* ed. 1983)("Evolution, which is the strongest natural explanation, holds that the gross features of the universe--including galaxies, solar systems and planets; the transition from non-living matter to living organisms; and the diversity of life forms, including human beings--all arose as a consequence of the innate proclivities of matter and energy, as expressed by the laws of nature.").

657. E.g., C. Sagan*, Cosmos 247 (1980) ("cosmic evolution"); Mayr*, Evolution, Scientific American, Sept. 1978 at 47, 47 ("cosmic evolution"); T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 349 (1977) (chapter 11 is entitled "Cosmic Evolution and the Origin of Life"); Gamow*, Modern Cosmology, 190 Scientific American 55, 60 (1954) ("Cosmos Evolved", "Universe's Evolution"); Dobzhansky*, A Biologist's World View, 175 Science 49, 49 (1972) ("cosmic evolution"); H. Blum*, Time's Arrow and Evolution 4 (3d ed. 1968)

example, Dobzhansky*, a late leading evolutionist, stated:

("cosmic evolution"); T. Dobzhansky*, Evolution, Genetics, and Man 1 (1955) ("cosmic evolution"); G. Stebbins* & W. Fitch*, Processes of Molecular and Organismic Evolution (in press) (chapter 11: "Cosmic Evolution"); J. Boodin*, Cosmic Evolution (1925, repr. _____); G. Gamow*, The Creation of the Universe 4-5 (1959) ("cosmic evolution," "universe resulted from a continuous evolutionary process," "stellar evolution"); Harneck*, Carl Sagan: Cosmic Evolution v. the Creationist Myth, Humanist, Jul.-Aug. 1981, at 5; Alfvén* & Mendis*, Interpretation of Observed Microwave Background Radiation, 266 Nature 698, 699 (1977) ("evolutionary cosmology"). "Stellar evolution" is also a generally accepted term. E.g., D. Clayton*, Principles of Stellar Evolution and Nucleosynthesis (1983); H. Miller*, Evolution: From Stellar Dust to Technolocgcal Society (1975); H. Goldberg* & M. Scadron*, Physics of Stellar Evolution and Cosmology (1984); Brown*, Stellar Evolution, American Atheist, Mar. 1982, at 21.

"Evolution of the universe" is similarly a generally accepted scientific term. E.g., Committee on Science and Creation*, Science and Creation: A View from the National Academy of Sciences, 11-12 (1984) ("evolution of the universe"); The Self-Organizing Universe: Scientific and Human Implications of the Emerging Paradigm of Evolution (_____ ed. 1980); J. Barrow* & J. Silk*, The Left Hand of Creation:

> Although this article is concerned with biological evolution, it should be recognized that the concept of evolution is much broader. . . . There is also cosmic, or inorganic, evolution, and evolution of human culture. One of the theories advanced by cosmologists sets the beginning of cosmic evolution between 5 and 10 billion years ago. The origin of life, which started biological evolution, took place 3 or 4 billion years ago.659/

The Origin and Evolution of the Expanding Universe (1983); I. Novikov*, Evolution of the Universe (1983); J. Silk*, The Big Bang: The Creation and Evolution of the Universe (1980); Gamow*, Modern Cosmology, Scientific American, March 1954, at 54, 26. ("Evolution of the universe"); DeFord*, Humanism and Atheism I, Humanist, July-Aug. 1971, at 5 ("evolution of the universe"); G. Whitrow*, The Structure and Evolution of the Universe (1959); K. Krauskopf* & A. Beiser*, The Physical Universe 645 (3d ed. _____) (heading "Evolution of the Universe"); R. Wald*, Space, Time, and Gravity 55 (1971) (chapter 5 is entitled "The Evolution of Our Universe"); Guth* & Steinhardt*, The Inflationary Universe, Scientific American, May 1984, at 116, 127 ("evolution of the universe").

658. Brief of Defendants at _____, Keith v. Louisiana Department of Education, No. 81-989B (M.D. La., filed Dec. 2, 1984).

659. T. Dobzhansky*, Evolution, in 10 Encyclopedia Americana 734, 734 (1982). Sir Julian Huxley* wrote similarly:

> I am quite aware that many people object to the use of the term evolution

Overview. The following material des-

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for anything but the transformations of living substance. But I think this is undesirably narrow. Some term is undoubtedly needed for the comprehensive process in all its aspects, and no other convenient designation exists at present save that of evolution.

The over-all process of evolution in this comprehensive sense comprises three main phases. . . . We may call these three phases the inorganic or, if you like, cosmological; the organic or biological; and the human or psychosocial.

J. Huxley*, Evolution in Action 10 (1964).

The National Academy of Science recently published a booklet that states:

The processes by which new galaxies, stars, and our own planetary system are formed are sometimes referred to as the "evolution" of the universe, the stars, and the solar system. The word evolution in this context has a very different meaning than it does when applied to the evolution of orgamisms. In both instances there is an unfolding, but the processes involved are entirely different. The relevant sciences involved are also different--biological sciences in the evolution of organisms and the physical sciences in the evolution of the universe and its constituent domains.

Evidence that the evolution of the universe has taken place over at least several billion years is overwhelming.

Committee on Science and Creation*, Science

cribes and evaluates the big bang hypothesis of cosmic evolution:

(a) Description of the Big Bang Hypothesis of Cosmic Evolution, (b) Problems with the Primary Evidence for the Big Bang Hypothesis, and (c) Problems with the Evolutionary Stages of the Big Bang Hypothesis.

The description in Section (a) follows Carl Sagan*, the ACLU expert witness in cosmology. The strongest alleged evidences for the big bang hypothesis and their difficulties are assessed in Section (b). The problems with and scientific evidence opposing the big bang hypothesis are treated in Section (c).

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and Creationism: A View from the National Academy of Sciences 11, 12 (1984). Accord, Evolution, 3 Oxford English Dictionary 354 (1961) ("8. The formation of the heavenly bodies according to the received theory which supposes it to have taken place by the concentration and consolidation of cosmic matter.").

(a) Description of the Big Bang Hypothesis of Cosmic Evolution. A typical high school textbook description of the big bang hypothesis is given in a Louisiana public school text:

> the cosmic background radiation, emanating from all parts of the sky can be detected by radiotelescopes today.
>
> The early universe was filled with radiation and a plenum of matter, originally hydrogen and helium, formed from elementary particles in the dense primeval fireball . . .. Then little pockets of gas, small nonuniformities began to grow. Tendrils of vast gossamer gas clouds formed, . . . each a kind of beast eventually to contain a hundred billion shining points. . . . We call them galaxies.
>
> About a billion years after the Big Bang, the distribution of matter in the universe had become a little lumpy, perhaps because the Big Bang itself had not been perfectly uniform.
>
> Their gravity drew to them substantial quantities of nearby gas, growing clouds of hydrogen and helium that were destined to become clusters of galaxies . . .
>
> . . . .
>
> Within the nascent galaxies, much smaller clouds were also experiencing gravitational collapse; interior temperatures became very high, thermonuclear reactions were initiated, and the first stars turned on. . . . The epic

> of cosmic evolution had begun, a hierarchy in the condensation of matter from the gas of the Big Bang 662/

There are two general formulations of the big bang hypothesis: the single big bang and the oscillating universe hypothesis. Sagan* leans toward the eternally oscillating approach, and that approach is generally atheistic in denying the existence and role of a creator.662a/ For example, Shapley* stated:

> In the very beginning, we say, were hydrogen atoms 663/

The single big bang approach is treated by a majority of its proponents as atheistic and as involving creation of matter and energy. Sagan* says:

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662. C. Sagan*, Cosmos 246-47 (1980).

662a. R. Jastrow*, Until the Sun Dies ____ (1977).

663. Shapley*, On the Evolution of Atoms, Stars and Galaxies, in Adventures in Earth History _____ (P. Cloud* ed. 197__).

> In one, the universe is created, somhow, ten or twenty billion years ago and expands forever, the galaxies mutually receding until the last one disappears over our cosmic horizon. In the other, the oscillating universe, the Cosmos has no beginning and no end, and we are in the midst of an infinite cycle of cosmic deaths and rebirths 664/

Many noted scientists, although a minority, reject the big bang hypothesis. One college textbook says that "[a] number of scientists are unhappy with the big bang theory . . .."665/ Examples are astronomer Halton C. Arp*,666/ physicist Hannes Alfvèn,667/ astronomers Sir Fred Hoyle and Jayant Narlikar* (quoted above),668/ astrono-

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664. C. Sagan*, Cosmos 259 (1980).

665. A. Krauskopf* & A. Beiser*, The Physical Universe 645 (3d ed. ___).

666. G. Field*, H. Arp* & J. Bahcall*, The Redshift Controversy (1974); H. Arp*, Atlas of Peculiar Galaxies (1966).

667. Alfvèn* & Mendis*, Interpretation of Observed Microwave Background Radiation, 266 Nature 698 (1977).

668. F. Hoyle, The Intelligent Universe 186 (1983). Accord, Hoyle, The Big Bang in Astronomy, 91 New Scientist 521,

mer N. Chandra Wickramasinghe,668a/ A. D. Allen*,669/ Guth* of MIT and Steinhardt* with their inflationary universe hypothesis, 670/ Gott* of Princeton with his big bubble hypothesis,671/ Bondi*,672/ and Rees*.673/ The noncompelling nature of the big bang hypothesis is a material factual issue.

(b) Problems with the Primary Evidence for the Big Bang Hypothesis. The two crit-

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526 (1981) ("I continue to be obstinately doubtful about the dead-and-done-for universe of the big-bang cosmologies.").

668a. F. Hoyle & N. Wickramasinghe, Evolution from Space (1981).

669. Allen*, The Big Bang Is Not Needed, 6 Foundations of Physics 59-63 (1976).

670. Guth* & Steinhardt*, The Inflationary Universe, Scientific American, May 1984, at 116.

671. Waldrop*, Bubbles Upon the River of Time, 215 Science 1082-1083 (1982).

672. Bondi*, Letter, _____ New Scientist, August 21, 1980, at 611 ("As an erstwhile cosmologist, I speak with feeling of the fact that theories of the origin of the Universe have been disproved by present day empirical evidence, as have various theories of the origin of the Solar System").

ical evidences supporting the big bang hypothesis (in addition to less important considerations) are red shift and cosmic background radiation, as Sagan* recognizes:

> The discovery of the Big Bang and the recession of the galaxies came from a commonplace of nature called the Doppler effect . . .
>
> This red shift, observed in the spectral lines of distant galaxies and interpreted as a Doppler effect, is the key to cosmology.
>
> . . . .
>
> The apparent recession of the galaxies, with the red shift interpreted through the Doppler effect, is not the only evidence for the Big Bang. Independent and quite persuasive evidence derives from the cosmic blackbody background radiation, . . . at just the intensity expected in our epoch from the now substantially cooled radiation of the Big Bang.674/

However, there are significant problems with each of these primary evidences for the big bang hypothesis, which are recog-

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673. Rees*, Origin of Pregalactic Microwave Background, 275 Nature 35 ____, (1978)

674. C. Sagan*, Cosmos 252-53, 256 (1980).

nized by some noncreationist scientists whose conclusions are discussed in the following Sections.675/ Creationist scientists do not question the existence of red shift and cosmic background radiation, but merely question (along with some noncreationist scientists) the interpretations of these facts as evidence for the big bang hypothesis.

(i) Red Shift. Astronomer Halton C. Arp* and others* have questioned whether the red shifts676/ actually arise from ex-

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675. Moreover, "all the evidence needed for a scientific study of the cause of the great explosion was melted down and destroyed" in "the searing heat of that first moment." R. Jastrow*, God and the Astronomers 12 (1978).

676. "Red shift" is defined as the "shift of a spectrum of light toward longer (redder) wavelengths." "Doppler redshifts" are caused by recession of one object in relation to another. "A gravitational red shift is the shift to longer wavelengths of light passing through a large gravitational field." Glossary of Terms Used in Cosmology 17-18 (P. Schewe ed. 1982) (American Insti-

pansion of the universe as big bang proponents believe, and thus whether the acknowledged occurrence of red shift provides any support at all for the big bang hypothesis. Sagan* summarizes the debate:

> The astronomer Halton Arp has found enigmatic and disturbing cases where a galaxy and a quasar, or a pair of galaxies, that are in apparent physical association have very different red shifts. Occasionally there seems to be a bridge of gas and dust and stars connecting them. If the red shift is due to the expansion of the universe, very different red shifts imply very different distances. But two galaxies that are physically connected can hardly also be greatly separated from each other--in some cases by a billion light-years. Skeptics say that the association is purely statistical; that, for example, a nearby bright galaxy and a much more distant quasar, each having very different red shifts and very different speeds of recession, are merely accidentally aligned along the line of sight; that they have no real physical association. Such statistical alignments must happen every now and then. The debate centers on whether the number of coincidences is

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tute of Physics) (also interpreting red shift to support the big bang hypothesis).

> more than would be expected by chance. Arp points to other cases in which a galaxy with a small red shift is flanked by two quasars of large and almost identical red shift. He believes the quasars are not at cosmological distances but instead are being ejected, left and right, by the "foreground" galaxy; and that the red shifts are the result of some as-yet-unfathomed mechanism. Skeptics argue coincidental alignment and the conventional Hubble-Humason interpretation of the red shift. If Arp is right, the exotic mechanisms proposed to explain the energy source of distant quasars--supernova chain reactions, supermassive black holes and the like--would prove unnecessary.677/

Arp* gives a large number of examples supporting his thesis that red shift does not result from expansion of the universe as required by the big bang hypothesis, such as examples in groups of quasars, in galaxies with discordant red shifts, in Holmberg's companions of more distant galaxies, in interacting double stars in the neighborhood of spiral galaxies, in multiple in-

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677. C. Sagan*, Cosmos 255-56 (1980).

teracting companion stars, in Stephan's quintet of galaxies, in chains of galaxies, in systems connected by luminous filaments, in typed groupings of bright galaxies, etc.677a/ Arp's* approach is supported by the internationally known astronomer Geoffrey Burbidge*, 678/ and similar arguments

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677a. G. Field*, H. Arp* & J. Bahcall*, The Redshift Controversy 1 (1974); H. Arp*, Atlas of Peculiar Galaxies ____ (1966); J. Silk*, The Big Bang 317-18 (1979).

678. Burbidge* writes:

> Like most of her colleagues, Rubin, in discussing quasars, manages to ignore any mention of the remarkable results obtained over the last decade or more by Halton Arp and others which by now provide strong evidence that not all red shifts are of cosmological origin. If this evidence is presented to any gathering of scientists who are not astronomers, as I have done on a number of occasions, it is accepted without any real debate. But among the professionals, it is largely ignored. Why? Perhaps because we have no physical theory which will explain the phenomenon, and this is not treated as a challenge but by many as an objection to the evidence. Perhaps because astronomers, knowing that their subject is this area already rests on rather shaky

are made by Rees* and by Allen*.679/ Moreover, the Hubble relation, of red shift being proportional to distance, has been challenged recently in published articles by several astronomers.680/ Finally, even

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foundations as far as hard-proven evidence is concerned, cannot face up to the opening of Pandora's box in extragalactic astronomy.

Rubin states, "most astronomers agree that there are no compelling reasons to doubt that the observed red shifts indicate enormous distances or to believe that 'new physics' is required to understand quasars." However the evidence is there, and if we are really searching for the truth, we ignore it at our intellectual peril. Burbidge*, Letters, ___ Science ___ (1980).

679. Rees*, Origin of Pregalactic Microwave Background, 275 Nature 35-37 (1978); Allen*, The Big Bang Is Not Needed, 6 Foundations of Physics 59-63 (1976); J. North*, The Measure of the Universe, _____ (1965) (describing other distance-dependent interpretations of red shifts that are nonrecessional); Gentry, Letter, Physics Today, Apr. 1983, at 13, 13 (a creationist scientist defending a revolving steady state hypothesis).

680. Nicoll* & * Segal*, 7&9 Proc. of National Academy for Sciences 3913 (1982); Nicoll* & S egal*, 72 Proc. of National Academy for Sciences 4601 (1975); I. Segal*,

if red shift does reflect proportional recession, that expansion of the universe does not require the big bang.681/ These arguments render noncompelling the primary argument for the big bang hypothesis.

(ii) Cosmic Background Radiation. Similar problems exist with the cosmic microwave background radiation682/ that provides the other primary evidence for the big bang hypothesis. One problem is pointed out by physicist Hannes Alfvèn*, who argues that the "claim that this radiation lends strong

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Nathematical Cosmology and Extragalactic Astronomy (1976); Hawkins*, _____ 194 Nature 563 (1962); but see Sandage*, Tammann*, * Yahil*, _____ 232 Ap. J. 352 (1979) (refuted in the 1982 Nicoll* article).

681. However, it would require the origin of the universe by some means at a time no longer ago than the point when all matter converged.

682. "Cosmic microwave background" is "a radiation background or radio 'hiss' at an equivalent blackbody temperature of 2.7 K[elvin]." Glossary of Terms Used in Comology* 4-5 (P. Schewe ed. 1982).

support to hot big bang cosmologies is without foundation."683/ He goes on to explain this conclusion:

> Just as the radiation received from the Sun gives us direct information only about its surface, the microwave background radiation gives us direct information only about the 'surface of last scattering' when the radiation finally decoupled from matter and beyond which the metagalaxy remained transparent.
>
> According to our model, this 'surface of last scattering' was the total dust distribution in galaxies or protogalaxies at the epoch Z [equals approximately] 40. Consequently, we cannot obtain direct information about the metagalaxy at earlier epochs (Z > 40), as it was then opaque. This conflicts with the detailed canonical model of the hot big bang cosmology . . ..
>
> We stress that the observed cosmic microwave background radiation does not give us direct information about the state of the metagalaxy further back than the epoch corresponding to Z [equals approximately] 40, when galaxies or protogalaxies already existed, and when its own temperature was only about 110K. To claim that it is

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683. Alfvén* & Mendis*, Interpretation of Observed Cosmic Microwave Background Radiation, 266 Nature 698, 698 (1977).

> strong evidence in support of the hot big bang cosmology whose earliest epochs correspond to $Z > 10^{12}$ with corresponding temperatures of matter and radiation $> 10^{10}$K, is completely unjustified.684/

Another problem is stressed by Hoyle and by Woody* and Richards*, who conclude that the cosmic background radiation does not support the big bang hypothesis, because the radiation is only a fraction of the level predicted by the big bang hypothesis:

> The big bang theory includes a microwave background . . . but this success is tempered by the fact that it was expected to be between ten and a thousand times more powerful than is acactually the case.685/

> The latest data differ by so much from what theory would suggest as to kill the big bang cosmologies. But now, because the scientific world is emotionally attracted to the big-bang cosmologies, the data are ignored.686/

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684. Id. at 699.

685. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 181 (1983).

686. Hoyle, The Big Bang in Astronomy,

A further problem is acknowledged by Sagan*, that the background radiation is not as homogeneous as was predicted:

> Independent and quite persuasive evidence derives from the cosmic blackbody background radiation. But here also there is something puzzling. . . . The background radiation, when examined to finer precision, proves to be imperfectly symmetrical.687/

Other researchers have similarly concluded that the cosmic background radiation does not support the big bang hypothesis.688/

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91 New Scientist 521, 522-523 (1981). Accord, Woody* & Richards*, _____, Fusion, March-April 1979, ____, at 66.

687. C. Sagan*, Cosmos 256 (1980). See also Stecker*, _____ [Patruskynz] (other inconsistencies between theoretical predictions of big bang hypothesis and amounts of helium and deuterium in universe).

688. Rees*, Origin of Pregalactic Microwave Background, 275 Nature 35 (1978); Allen*, The Big Bang Is Not Needed, 6 Foundations of Physics 59 (1976); J. Silk*, The Big Bang 326 (1979) ("blackbody radiation could be a result of dissipation of primordial irregularities").

Summary. Thus, red shift does not necessarily support the big bang hypothesis, and the cosmic background radiation does not "lend strong support." In view of this nonsupport from its two primary evidences, the big bang hypothesis of cosmic evolution is noncompelling. These are material factual issues.

(c) Problems with Evolutionary Stages of the Big Bang Hypothesis. There are a number of other problems with each stage of the big bang hypothesis, which show it to be noncompelling if not incorrect. These include: (i) the source of matter and energy for the oscillating big bang hypothesis, (ii) the cause of concentration of the universe into an incredibly compressed state, (iii) the cause of the incredibly precise rate of expansion required after the explosion, (iv) the cause of galaxy and star formation, and (v) the cause of complex

information and order.691/ These are material factual issues.

(i) Source of Matter and Energy. Under the oscillating big bang hypothesis, the universe with its matter and energy is eternal. However, the existence of unconsumed hydrogen rules out an eternal universe, according to astronomer Jastrow*.692/ Under either approach to the big bang theory, the origin of the universe of matter and energy is "unknowable," in the words of Shapley*:

> In the very beginning, we say, were hydrogen atoms; of course there must have been something antecedent, but we

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691. Silk* mentions problems (ii) and (iv): "The Big Bang theory has not yet resolved three fundamental issues--what happened prior to the initial instant, the nature of the singularity itself, and the origin of the galaxies." J. Silk*, The Big Bang 315 (1979).

692. R. Jastrow*, God and the Astronomers 109 (1978); P. Davies*, The Runaway Universe 27 (1980); F. Hoyle, The Nature of the Universe 125 (1950).

> are not wise enough to know what. Whence came these atoms of hydrogen, these atoms, 20,000,000,000,000 (and 66 additional zeros) in number--atoms that we now believe have been forged into the material makeup of the universe? What preceded their appearance, if anything? That is perhaps a question for metaphysics. The origin of origins is beyond astronomy. It is perhaps beyond philosophy, in the realm of the to us Unknowable.693/

Natural laws do not answer this question.

(ii) Cause of Concentration. A second problem with the big bang hypothesis is the cause of concentration of the universe into an incredibly dense compressed state, the "cosmic egg." This cause was simply "some unknown force," according to Jastrow*:

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693. Shapley*, On the Evolution of Atoms, Stars/Galaxies, in Adventures in Earth History (P. Cloud, ed. 1963). Accord, A. Krauskopf* & A. Beiser*, The Physical Universe 645 (3d ed. 19__) ("A number of scientists are unhappy with the big bang theory . . .. For one thing, it leaves unanswered the questions that always arise when a precise date is given for the creation of the universe: . . . Where did the matter come from in the first place?").

> But assuming that some unknown force brought the Universe into being in a hot and highly compressed state, physicists can predict with confidence what happened thereafter.694/

Alfvèn* notes:

> Proponents of the theory turn extremely vague when asked about what happened before the big bang. Sometimes they suggest that a prior universe existed and may have been very much like the one we have now. It then contracted to form an ylem.695/

Again, natural laws do not provide an answer.

(iii) Cause of Precise Expansion. Another serious problem with the big bang hypothesis is the cause of the incredibly pre-

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694. R. Jastrow*, God and the Astronomers 125 (1978). Accord, A. Krauskopf* & A. Beiser*, The Physical Universe 645 (3d ed. 19___) ("A number of scientists are unhappy with the big bang theory. . . . For one thing, it leaves unanswered the questions that always arise when a precise date is given for the creation of the universe: Why was all matter concentrated in one tiny region? What was the universe like before the explosion started?").

695. H. Alfvèn*, Worlds-Antiworlds 17 (1966). See also Abell*, Exploration of the Universe 648 (4th ed. 1982).

cise rate of expansion that the hypothesis requires, as summarized by Lake*:

> What we find from this is that the initial data (expansion rate and density), specified at a time 10^{-39} second after the Bang, have to be tuned to an accuracy of one part in 10^{50}, even though ρ is so poorly known today. This tuning would have to be done to 1 part in 10^{14} even if we imagined starting the Universe just before the light elements were formed.696/

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696. Lake*, Windows on a New Cosmology, 224 Science 675, 678 (1984). Accord, Leslie*, Cosmology, Probability, and the Need to Explain Life, in Scientific Explanation and Understanding 53, 54 (N. Rescher* ed. 1983)("Yet the now standard (Friedmann-Robertson-Walker) models of our universe are extremely sensitive to small changes in the expansion rate (and hence to the strength of the gravitational force). Reduction by one part in a million million at an initial stage would seemingly have led to recollapse in under 100,000 years and before temperatures had fallen below 10,000 degrees. Equivalently tiny increases would have had similarly huge results. Even as matters stand it is hard to see how galaxies could have formed in a universe which is flying apart so fast--and an early speed increase by one thousandth would quickly have led to a thousandfold increase. (b) Again, very slight reductions in the smoothness with which matter is distributed . . . (c) Carbon, probably crucial to all living things, can be synthesized in stars only

A related problem is the incredibly precise

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thanks to the strong nuclear force's being one part in a hundred neither stronger nor weaker than it actually is. A 2% increase in this same force would probably stop quarks forming protons, essential constituents of all atoms; if not, then a 10% increase would yield a stable bi-proton so that no hydrogen (essential to water and to long-lived stable stars) would come out of the Big Bang; a decresse of 15% or less would make syntehsis of elements other than hydrogen impossible. (d) Slight changes in the weak nuclear force would again have stopped any hydrogen coming out of the Bang, probably also making it impossible for supernovae to scatter the heavy elements out of which living things are built. (e) Increaese in electromagnetism's strength by a factor of 1.6 would result in rapid decay of protons into leptons according to recent Unified Theories; if not, then a threefold increase in the electron's charge (which is a manifestation of this strength) would make all by hydrogen impossible, while a comparable decrease would mean than even intersellar heat would destroy all neutral atoms. (f) For there to exist the couple of hundred stable elements which are the basis of chemistry and biology, the mass of the neutron must exceed that of the proton but only by about twice the mass of the electron--and that means by only one part in a thousand. . . And so on and so on. all which is against the background of the facts, (i), that gravitation, electromagnetism and the weak and strong forces are believed to have had equal strengths in the

relations of the four universal forces required by the big bang hypothesis, as described by Leslie*:

> (c) Carbon, probably crucial to all living things, can be synthesized in stars only thanks to the strong nuclear force's being to one part in a hundred neither stronger nor weaker than it actually is. A 2% increase in this same force would probably stop quarks forming protons, essential constituents of all atoms; if not, then a 10% increase would yield a stable bi-proton so that no hydrogen (essential to water and to long-lived stable stars) would come out of the Big Bang; a decrease of 15% or less would make synthesis of elements other than hydrogen impossi-

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universe's early instants, this symmetry later being broken spontaneously and perhaps largely arbitrarily in phase transitions which also allocated non-zero rest masses to all quarks, leptons, intermediate bosons and superheavy bosons; and (ii), that the four forces not have strengths differing so greatly that the strongest is ten thousand billion billion billion billion times more powerful than the weakest."); see Guth* & Steinhardt*, The Inflationary Universe, Scientific American, May 1984, at 116, 116-19 ("It is also assumed that the early universe was filled with an almost perfectly uniform, expanding, intensely hot gas of elementary particles in thermal equilibrium.")

ble. (d) Slight changes in the weak nuclear force would again have stopped any hydrogen coming out of the Bang, probably also making it impossible for supernovae to scatter the heavy elements out of which living things are built. (e) Increase in electromagnetism's strength by a factor of 1.6 would result in rapid decay of protons into leptons according to recent Unified Theories; if not, then a three-fold increase in the electron's charge (which is a manifestation of this strength) would make all but hydrogen impossible, while a comparable decrease would mean that even interstellar heat would destroy all neutral atoms. (f) For there to exist the couple of hundred stable elements which are the basis of chemistry and biology, the mass of the neutron must exceed that of the proton but only by about twice the mass of the electron--and that means by only one part in a thousand . . . And so on and so on. All which is against the background of the facts, (i), that gravitation, electromagnetism and the weak and strong forces are believed to have had equal strengths in the universe's early instants, this symmetry later being broken spontaneously and perhaps largely arbitrarily in phase transitions which also allocated non-zero rest masses to all quarks, leptons, intermediary bosons and superheavy bosons; and (ii), that the four forces now have strengths differing so greatly that the strongest is ten thousand billion billion billion billion times more powerful than the weakest.697/

These requirements are extraordinarily improbable under natural laws, which again give little encouragement to the big bang hypothesis.

(iv) Cause of Galaxy and Star Formation. A fourth problem with the big bang hypothesis is that rapid expansion and high temperatures after the explosion would prevent the formation of galaxies and stars, as discussed above.698 / Natural laws acting on an explosion would not form galaxies, as Hoyle notes:

> The big bang theory holds that the universe began with a single explosion. Yet as can be seen below, an explosion merely throws matter apart, while the big bang has mysteriously produced the opposite effect, with matter clumping together in the form of galaxies.
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> . . ..
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> However, we actually have a universe

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697. Leslie*, Cosmology, Probability, and the Need To Explain Life, in Scientific Explanation and Understanding 53, 54 (N. Rescher* ed. 1983).

698. Section 2[c](1)(e) supra.

> of continuing activity instead of one that is uniform and inert. Instead of matter all the time becoming colder and more spread out, we often see it clustering together to produce the brilliant light of swirling galaxies and exploding stars. Why should this be so against expectations which appear soundly based in all other aspects of physical experience?
>
> Although it does not receive much publicity, this predicted inertness of the expanding Universe according to the big bang theory is still a major headache for its supporters.699/

(v) Cause of Complex Information and Order. Another serious problem for the big bang hypothesis is the complex information and order in the universe, which was described above.700/ Explosions cause disorder and not order or information, as astronomer Hoyle points out:

> even though outward speeds are maintained in a free explosion, internal motions are not. Internal motions die

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699. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 184-85 (1983).

700. Section 2[c](1')(c) supra.

> away adiabatically, and the expanding system becomes inert, which is exactly why the big bang cosmologies lead to a universe that is dead and done with almost from its beginning.701/

This dying away of internal motions occurs according to the second law of thermodynamics, a natural law, because the universe is an isolated system. Although fluctuations can occur, the second law of thermodynamics precludes fluctuations vast enough to yield the complex order of the known universe.702/

Summary. Thus, the various stages of the big bang hypothesis, like its primary evidences, also involve serious problems.

Conclusion. The big bang hypothesis of cosmic evolution is not compellingly established, and has "serious difficulties" both with its primary evidences and with

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701. Hoyle, The Big Bang in Astronomy, 91 New Scientist 521, 523 (1981).

702. Section 2[c](1)(a) supra.

its alleged stages:

> [A] number of serious difficulties have to be ignored, swept under the rug, difficulties which indeed it may never be possible to resolve from within this particular theory.703/

These are material factual issues.

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703. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 179 (1983). Accord, Allen*, The Big Bang Is Not Needed, 6 Foundations of Physics 59 (1976).

d. Accepted Definitions of Science Conflict with the McLean Definition

Summary. This Section discusses the definition of science, which is a material factual issue and will be supported by philosophy testimony at trial. The most widely accepted definitions are presented in Section (1). The basis of the ACLU's definition in the particular philosophies of positivism and materialism is outlined in Section (2). The erroneous and tactically contrived nature of the ACLU definition of science,712/ which was adopted in the McLean opinion, which one anti-creationist philosopher analyzes as "remote from well-founded opinion in the philosophy of science," is discussed in Section (3). Each of the McLean factors is rejected by a major-

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712. Note 756 infra.

ity of philosophers of science: guidance and explanation by natural law, testability, falsifiability, and tentativeness.713/ Finally, the inconclusiveness of the majority assessment by scientists is suggested by Section (4). Each of these points is itself a material factual issue.

(1) Prevailing Definitions as Logical Inferences from Empirical Observations

The definition of science is determined by philosophers and not by scientists.714/ Among philosophers of science, "there has been little agreement concerning a univers-

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713. Id. at 1267. Section 2[d](3) infra.

714. A. Whitehead*, The Function of Reason 48 (1929); see Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology at 7, 9 (R. Laudan ed. 1983); I. Lakatos*, The Methodology of Scientific Research Programmes 124 (J. Worrall & G. Currie eds. 1978).

al criterion of the scientific character of theories,"715/ as Lakatos* and others note:

> [P]hilosophy has largely failed to deliver the relevant goods. Whatever the specific strengths and deficiencies of certain wellknown efforts at demarcation (several of which will be examined below), it can be said fairly uncontroversially that there is no demarcation line between science and non-science, or between science and pseudo-science, which would win assent from a majority of philosophers.716/

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715. 1 I. Lakatos*, The Methodology of Scientific Research Programmes 124 (J. Worrall & G. Currie eds. 1978) (Lakatos* notes that there has been agreement on the scientific nature of many single achievements).

716. Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology at 7, 9 (R. Laudan ed. 1983). Accord, Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology at 7, 30 (R. Laudan ed. 1973) ("For most of this century, numerous scientists and some philosophers have acted, especially in their more public pronouncements, as if there were clear conceptions of the 'scientific' and the 'pseudo-scientific.' Various forms of intellectual activity (ranging from the so-called social sciences to even less respectable matters like Velikovsky and psychokinesis) have been repeatedly labelled by many scientists and philosophers as 'un-

Moreover, most proposed lines for demarcation between science and nonscience fail because they include or exclude too much.717/ To compound the problem, the lines of demarcation themselves shift.718/ Several schools

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scientific' or 'pseudoscientific.' Such pejorative accusations have generally been issued with a confidence and an air of authority that is completely out of character with the murkiness which actually afflicts our conception of the 'scientific.'"); Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 18 (1982)("few authors can even agree on what make an activity scientific").

717. Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology at 7, 20 (R. Laudan ed. 1983) ("Without conditions which are both necessary and sufficient, we are never in a position to say 'this is scientific: but that is unscientific.' Hence a demarcation criterion which fails to provide both sorts of conditions simply will not perform the tasks expected of it.")

718. T. Kuhn*, The Structure of Scientitic Revolutions 103 (2d ed. 1970) ("As a result, the reception of a new paradigm often necessitates a redefinition of the corresponding science. Some old, problems may be relegated to another science or declared entirely unscientific.' Others that were previously non-existent or trivial

of thought argue that demarcation is not possible, as mentioned below.

The one thing that is absolutely clear, in considering the various proposed definitions of science, is that no group of philosophers of science had formulated a definition even remotely resembling the McLean definition of science, and no group of philosophers of science have subsequently endorsed anything remotely resembling that definition (except certain ACLU expert witnesses propounding a contrived definition for tactical purposes). One philosopher of science has responded that "the criteria which Judge Overton offered [in McLean] as 'essential conditions' of science are noth-

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may, with a new paradigm, become the very archetypes of significant scientific achievement. And as the problems change, so, often, does the standard that distinguishes a real scientific solution from a mere metaphysical speculation, word game, or mathematical play.").

ing of the sort," and that the McLean opinion made "anachronistic efforts to revive a variety of discredited criteria" and gave "a false stereotype of what science is,"719/ as discussed further below.720/

This Court should not and need not define science in this case. Instead, it need only hold that courts will not limit the meaning of science to the particular minority viewpoint endorsed by the ACLU (positivism and materialism), and that creation-science is scientific under virtually all other widely accepted definitions of science.

Overview. The following Sections discuss the majority definitions, the minority

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719. Laudan*, More on Creationism, in Science, Technology and Human Values, 36, 36 (1983); Laudan*, Commentary: Science at the Bar--Cause for Concern, 7 Science, Technology and Human Values, 16, 19 (1982).

720. Sections 2[d](3) and 2[e] infra.

definition advocated by the ACLU, and text-book definitions of science:

(a) Variety of definitions of science, and (b) Universal rejection of the textbook definition of science.

(a) Variety of Definitions of Science. The most generally accepted definition of science involves "logical inferences from empirical observations," according to Ziman*:

> Science Arrives at Truth by Local Inferences from Empirical Observations. This is the standard type of definition favoured by most serious philosophers. It is usually based upon the principle of induction--that what has been seen to happen a great many times is almost sure to happen invariably and may be treated as a basic fact or Law upon which a firm structure of theory can be erected.721/

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721. Ziman*, What is Science?, in Introductory Readings in the Philosopher of Science, 35, 37 (E. Klemke, R. Hollinger* A. K line eds. 1980). Bertrand Russell* gives a similar description: "science is that sort of knowledge which gives causal

This is consistent with the Oxford English Dictionary's definition of science.722/

There are as many definitions of science as there are philosophers of science,

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understanding." Russell*, The Scientific Outlook, in Basic Problems of Philosophy at _____, 268 (_. Bronstein, _. Krikorian & _. Weiner eds. 1955). Science includes "purely descriptive science" (such as classification and systematics) as well as "experimental science." W. Stansfield*, The Science of Evolution 8 (1977).

722. It defines "science" as follows:

> 1. The state or fact of knowing; knowledge or cognizance of something specified or implied; also, with wider reference, knowledge (more or less extensive) as a personal attribute. . . .
>
> 2. Knowledge acquired by study; acquaintance with or mastery of any department of learning. . . .
>
> 3. A particular branch of knowledge or study; a recognized department of learning. . . .
>
> 4. In a more restricted sense: A branch of study which is concerned either with a connected body of demonstrated truths or with observed facts systematically classified and more or less colligated by being brought under general laws, and which includes trustworthy methods for the discovery of new truth within its own domain.

9 Oxford English Dictionary, 221 (1961).

but these definitions fall into a dozen general categories. (i) The approach of Baconian inductivism, initiated by Sir Francis Bacon, and developed by Sir Isaac Newton, was dominant in the seventeenth through nineteenth centuries and currently still commands a major following. It emphasizes, as the necessary scientific method, "exhaustive induction" based on "empirically observed facts."723/

(ii) The vocational approach defines science as what scientists do, and defines scientists as individuals who meet two of the following three factors: (i) a Ph.D. degree or the equivalent in the field, (ii) research or study in the field, and (iii) membership in professional societies in the field.724/

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723. S. Toulmin*, Science, Philosophy of, 16 Encyclopaedia Britannica 375, 378-79 (15th ed. 1974).

(iii) The Popperian approach, first developed by Sir Karl Popper*, draws the line of demarcation at falsifiability: "the criterion of the scientific status of a theory is its falsifiability, or refutability, or testability."725/ Criticisms by the majority of philosophers of science of Popper's falsification approach are given below.726/

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724. See T. Kuhn*, Second Thoughts on Paradigms, in The Structure of Scientific Theories, 459 461-62. (F.Supp.* 2d ed. 19_); Section 2[d](4) infra.

725. Popper*, Science: Conjectures and Refutations, in Introductory Readings in the Philosophy of Science 23 (E. Klemke, R. Hollinger & A. Kline eds. 1980) Accord, id. at 22; Popper*, Conjectures and Refutations 33-37 (1963) ("4. A theory which is not refutable by any conceivable event is nonscientific. Irrefutability is not a virtue of a theory (as people often think) but a vice.").

726. Section 2[d](3)(c) infra. E.g., I. Lakatos*, The Methodology of Scientific Research Programmes 3-4 (J. Worrall & G. Currie eds. 1978); Laudan*, The Demise of the Demarcation Problem , in approach of Norwood Russell Hanson*, influenced by Charles Peirce*, 2 Working Papers in Science

(iv) The Kuhnian or sociological approach, developed by Professor Thomas S. Kuhn* of Princeton, involves the initial paradigm of the scientific community engaged in normal science, and the anomalies that arise from research and sophistication. A scientific revolution results from persistent anomalies, and a new paradigm results and goes through the same process.727/ Contrary to Popper*, Kuhn* finds the demarcation between science and nonscience in the lack of testing rather than in the practice of testing theories.728/ Criticism

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and Technology at 7, 23 (R. Laudan ed. 1983); Kuhn*, Logic of Discovery or Psychology of Research?, in Criticism and the Growth of Knowledge, 13 (I. Lakatos* & A. Musgrave eds. 1970); P. Duhem*, The Aim and Structure of Physical Theory (2d ed. P. Weiner trans. 1954).

727. T. Kuhn*, The Structure of Scientific Revolutions 92, 94, 97 (2d ed. 1970).

728. Watkins*, Against 'Normal Science', in Criticism and the Growth of Knowledge, 25, 29 (I. Lakatos & A. Musgrave eds. 1970) (Kuhn* states: "it is normal

of Kuhn's* approach has focused on the artificial or unilluminating nature of his dichotomy between normal science and abnormal science, and the apparent relativism of scientific truth that his approach seems to involve.729/

(v) There are many other approaches to defining science. The emphasizes that the scientific process (which he called retroduction) while only quasi-logical, pushes a scientific theory toward more or toward less intelligibility and explanation.730/

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science, in which Sir Karl's sort of testing does not occur, rather than extraordinary science which most nearly distinguishes science from other enterprises.") Accord, Kuhn*, Logic of Discovery or Psychology of Research?, in id. at 1, 10.

729. 1 S. Toulmin*, Human Understanding 76, 98-119 (1972); Popper*, Normal Science and Its Dangers, in Criticism and the Growth of Knowledge 51, 56-58 (I. Lakatos & A. Musgrave eds. 1970).

730. N. Hanson*, Patterns of Discovery: An Inquiry into the Conceptual Foundations of Science 72-90 (1972).

The empiricist approach "argued for a view that made prediction the crucial test of scientific validity," while the rationalist approach "saw coherence and scope as the crucial requirements."731/

The operationalist viewpoint equates science with its procedures.732/ Feigl* proposes five criteria for distinguishing science: intersubjective testability, reliability, definiteness and precision, coherence, and comprehensiveness.733/ Klemke*

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731. S. Toulmin*, Science, Philosophy of, 16 Encyclopaedia Britannica 375,387-88 (15th ed. 1974). The constructivist viewpoint held that "the essential test of a science is that it should provide coherent, consistent, and wide-ranging theoretical organizations." Id. at 388.

732. Ziman*, What Is Science?, in Introductory Readings in the Philosophy of Science, 35, 37 (E. Klemke, R. Hollinger & A. Kline eds. 1980). Accord, P. Bridgman*, The Logic of Physics 5 (1927) ("In general, we mean by any concept nothing more than a set of operations; the concept is synonymous with the corresponding set of operations.") (emphasis omitted).

733. Klemke*, Introduction, Introduc-

proposes instead four different factors: classifications, laws and hypotheses, theories connecting laws, and deductions confirmed by observation and testing.734/ Hempel* argued for verification through testability.735/

(vi) There are several anti-definitional viewpoints. One asserts that it is impossible to define science or to draw a line of demarcation from other disciolines.736/ Feyerabend* of Berkeley essentially takes the approach of epistemological anarchy in encouraging the use of hypotheses that are

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tory Readings in the Philosophy of Science 1, 14 (E. Klemke, R. Hollinger & A. Klein eds. 1980); id. at 16 ("many writers have rejected some (or all) o[f] those criteria").

734. Id. at 16-17.

735. C. Hempel*, Philosophy of Natural Science 30-32 (1966); C. Hempel*, Aspects of Scientific Explanation, Ch. 4 (1965).

736. Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology, 7___ (R. Laudan ed. 1983).

ad hoc, contradictory to accepted experimental results, less persuasive than alternatives, or even refuted by prevailing scientific sentiment.737/ He further claims that scientific progress has actually resulted from the very violation of the accepted rules of scientific method.738/

(viii) Finally, the approaches of positivism and materialism assert that true science must be based only on sense experi-

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737. P. Feyerabend*, Against Method: Outline of an Anarchistic Theory of Knowledge 20-31, 49, 65, 68 (1978).

Several reasons are given for using unconventional hypotheses: that evidence allegedly supporting the majority theory may be improperly excluded, that no single interesting theory agrees with all known facts in its domain, that no idea has ever been examined in all its ramifications, that critical assessment of a prevailing theory can best be made from outside that theory, and that criticism based on abandoned explanations has often led to innovative developments.

738. Id. at 304.

ence and verifiable data, excluding any metaphysical, ethical, and other nonmaterial considerations. A description and criticisms of these viewpoints are given below.739/

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739. Section 2[d](2) infra. Various other proposed criteria for science have been widely rejected. Philosophers of science have rejected a requirement for scientific matter to generate predictions. Scriven*, Explanation and Prediction in Evolutionary Theory, 130 Science 477, 477 (1959) ("The most important lesson to be learned from evolutionary theory today is a negative one: the theory shows us that one cannot regard explanations as unsatisfactory when they do not contain law, or when they are not such as to enable the event in question to have been predicted. . . . [T]he thesis of this article is that scientific explanation is perfectly possible in the irregular subjects even when prediction is precluded."); 1 I. Lakatos*, The Methodology of Scientific Research Programmes 106 (J. Worrall & G. Currie eds. 1978)("False theories may have great predictive power."). They have also rejected any requirement of cognitive progress. Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology at 7, 27 (R. Laudan ed. 1983) ("Similarly, cognitive progress is not unique to the 'sciences.' Many disciplines (e.g., literary criticism, military strategy, and perhaps even philosophy) can claim to know more about their respective domains than

(b) Universal Rejection of the Textbook Definition of Science. The general textbook definition of science is as follows:

> A common characterization of science (or sometimes of scientific method) runs as follows. Science is knowledge obtained by: (1) making observations as accurate and definite as possible; (2) recording these intelligibly; (3) classifying them according to the subject matter being studied; (4) extracting from them, by induction, general statements (laws) which assert regularities; (5) deducing other statements from these; (6) verifying those statements by further observations; and (7) propounding theories which connect and so account for the largest possible number of laws. It is further maintained that this process runs from (1) through (7) in that order.

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they did 50 or 100 years ago. By contrast, we can point to several 'sciences' which, during certain periods of their history, exhibited little or no progress. Continuous, or even sporadic, cognitive growth seems neither a necessary nor a sufficient condition for the activities we regard as scientific."). Finally, they have rejected proposed requirements for welltestedness, high rates of growth, success of predictions, concilience of inductions. Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology at 7, 28 (R. Laudan ed. 1983).

> The conception of science has been challenged in recent years. Its most severe critic is Sir Karl Popper. . . . Instead we offer a characterization of science which some believe to be more adequate that the one mentioned above and which they deem to be free from the defects it possesses.740/

This widely-used definition does not conform to any definition widely accepted by philosophers of science, and in fact is generally condemned as simplistic and wrong.741/

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740. Klemke*, Introduction, in Introductory Readings in the Philosophy of Science 11, 16 (E. Klemke, R. Hollinger & A. Kline eds. 1980). Accord, Biological Sciences Curriculum Study*, Biological Science: Molecules to Man __ (3d ed. 1976); J. Otto*, A. Toule* & M. Madnick*, Modern Biology ___ (1977).

741. 1 I. Lakatos, The Methodology of Scientific Research Programmes 2-3 (J. Worral & G. Currie eds. 1978) ("One can today easily demonstrate that there can be no valid derivation of a law of nature from any finite number of facts; but we still keep reading about scientific theories being proved from facts. Why this stubborn resistance to elementary logic?"); Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology at 7, 15 (R. Laudan ed. 1983) ("At first blush, this program of identifying science with a certain technique of inquiry is not

Summary. Thus, there are many widely-accepted definitions of science and lines of demarcation from nonscience, of which logical positivism is only one minority viewpoint. No definition widely accepted among philosophers of science even remotely resembles the ACLU's definition or the McLean definition. This Court should not restrict the definition of science to the particular narrow viewpoint advocated by the ACLU. Under the other widely-accepted definitions --and under the McLean definition (as discussed below)--creation-science is as sci-

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a silly one; indeed, it still persists in some circles even in our time."); see Eldredge* & Gould*, Punctuated Equilibria: An Alternative to Phyletic Gradualism, in Models in Paleobiology at 82, 85 (J. Schopf ed. 1972) ("(1) We do not encounter facts as data (literally "given") discovered objectively. All observation is colored by theory and expectation . . . (2) Theory does not develop as a simply and logical extension of observation; it does not arise merely from the patient accumulation of facts.").

entific as evolution. The definition and demarcation of science are material factual issues.

(2) ACLU Definition of Science from Positivism and Materialism. The ACLU's position and approach in defining science in this case are essentially based on logical positivism. Logical positivism is defined as follows in Encyclopaedia Britannica:

> The characteristic theses of positivism are that science is the only valid knowledge and facts the only possible objects of knowledge . . .. Positivism, consequently, denies the existence or intelligibility of forces or substances that go beyond facts and the laws ascertained by science. It opposes any kind of metaphysics and, in general, any procedure of investigation that is not reducible to scientific method.742/

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742. Abbagnano*, Positivism, 6 Encyclopedia of Philosophy 414, 414 (P. Edwards ed. 1967). Accord, Feigl*, Positivism and Logical Empiricism, 14 Encyclopaedia Brittannica 877, 877 (15th ed. 1974); Carlson*, Science and the Supernatural, 78 Science 217,____ (1931) ("What is the method of

One of several kinds of positivism is in fact "evolutionary positivism":

> There are two fundamental kinds of positivism: social positivism, with a professedly practicopolitical character, and evolutionary positivism, with a professedly theoretical character. . . . A materialistic or spiritualistic metaphysics is often associated with evolutionary positivism.742a/

Materialism, or its variety known as naturalism, is defined as follows in Encyclopaedia Britannica:

> This modified form of Materialism is perhaps better described as naturalism. Naturalism holds not that all things consist of matter or its modifications but that whatever exists can be satisfactorily explained in natural

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science? In essence it is this-the rejection in toto of all non-observational and non-experimental authority in the field of experience. . . . The scientist tries to rid himself of all faiths and beliefs. He either knows or he does not know. If he knows, there is no room for faith or belief. If he does not know, he has no right to faith or belief." Positivism is further discussed in Section 3[b](5)(a) infra.

742a. Abbagnano*, Positivism, 6 Encyclopedia of Philosophy 414, 415 (P. Edwards ed. 1967).

> terms. To explain something in natural terms is to explain it on scientific lines; naturalism is in fact a proclamation of the omnicompetence, or final competence, of science.742b/

The positivist and materialist foundation of the ACLU's definition is evident in its rigorous limitation of science to natural laws and its insistence on verification (testing and falsifiability) of all events (even if unique past events) in order to be scientific.743/

742b. Id.

742c. _____*, Metaphysics, 12 Encyclopedia Britannica _____, 26 (15th ed. 1974). Materialism is further discussed in Section 3[b](5)(a) infra.

743. Memorandum of Plaintiffs in Support of Summary Judgment at ____, Aguillard v. Edwards, No. 81-4787 (E.D. La. filed Dec. 3, 1981). Gillespie* sees the conflict between evolution and "creationism" as being between the world views of "positivism" and "creationism." N. Gillespie*, Charles Darwin and the Problems of Creation (1979). Philosopher John Greene* notes the relation of "positivistic faith" to Darwinism (discussed further in Section 3[b](5) infra):

> A final ingredient in the world view that came to be called Darwinism was the stream of Lockean epistemology

Positivism is only one particular definition of science that is a minority approach rather than the prevailing definition among philosophers.744/ It has been criticized by the majority of philosophers of science on various grounds. First, the basic principle of logical positivism (that

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and sensationalist psychology that ran strong in the English-speaking world and taught all whom it influenced to reject notions of innate ideas, intuition, and the like and to rely upon sense experience as the source of all knowledge. In the nineteenth century this intellectual tendency was powerfully reinforced and given new expression by a growing positivistic faith in the methods of natural science as man's sole means of gaining knowledge of reality. Since science was increasingly conceived as the search for the laws governing the phenomena presented in sense experience, the hope of discovering or knowing a reality behind the veil of sense experience diminished as the prestige of science grew. Positivism led to agnosticism.

J. Greene*, Science, Ideology, and World View 133 (1981).

744. _____*, Logical Positivism, _____.

all meaningful scientific statements are verifiable by sense experience) is itself a metaphysical principle that cannot be verified by sense experience.745/ Second,

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745. Ewing*, Meaninglessness, in 5 Encyclopedia of Philosophy 705 (P. Edwards ed. 1972); A. Ewing*, The Fundamental Questions of Philosophy 44-47 (1962). Alfred North Whitehead* wrote:

> The doctrine that science starts from clear and distinct elements in experience and that it develops by a clear and distinct process of elaboration, dies hard. There is a constant endeavor to explain the methodology of science in terms by which reason of their clarity and distinctness, require no metaphysical elucidation. . . . But when we press the question so as to determine without ambiguity the procedure of science, we become involved in the metaphysical formulations of speculative Reason.
>
> . . ..
>
> The claim of science that it can produce an understanding of its procedures within the limits of its own categories, or that those categories themselves are understandable without reference to their status within the wider categories under exploration by the speculative Reason -- that claim is entirely unfounded. Insofar as philosophers have failed, scientists do not know what they are talking

the concept of verification assumes the validity of inductive inferences; yet David Hume is credited with having shown that all attempts to validate inductive inferences depend on inductive reasoning and thus have circularity problems.746/ Third, historians of science have persuasively argued that modern science not only arose from a nonnaturalistic foundation but actually depended for its rise on belief in a creator as a basis for an orderly universe that could offer natural laws, as discussed below.747/

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about when they pursue their own methods; and insofar as philosophers have succeeded, to that extent scientists can attain an understanding of science. A. Whitehead*, The Function of Reason ____ (1929).

746. See W. Salmon*, The Foundation of Scientific Inference 5-56 (1967) (summary of problem of induction and proposed solutions).

747. Sections 2[d](3)(a) and 3[b](4) infra.

748. See L. Laudan*, Progress and Its Problems 132 (197__) ("Far from viewing the introduction of philosophical, religious

Fourth, logical positivism presupposes materialism (that the only reality is material and that the metaphysical-spiritual (including the ethical) does not exist), which itself is open to various criticisms.748/ Fifth, logical positivism in excluding non-naturalistic concepts would bar science from considering some truth or knowledge, such as the possibility of the existence of a creator and the occurrence of creation, leaving science in the strange position of potentially being limited to something false and not able to embrace something true.749/

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and moral issues into science as the triumph of prejudice, superstition and irrationality, this model claims that the presence of such elements may be entirely rational; further, that the suppression of such elements may itself be irrational and prejudicial.")

749. Geisler, _____. Dr. Wernher von Braun, the late Director of NASA's Marshall Space Flight Center (and a creationist scientist), noted that "the scientific method does not allow us to exclude data which lead to the conclusion that the universe, life and man are based on de-

Einstein* wrote that the "weak point of positivists" is that scientists have to be resigned to recognizing nonnaturalistic events that cannot be further explained.750a/

The ACLU has also compiled a list of the alleged "methods of science":

> 134. Science is also distinguished from nonscience by its methods which are at least (a) objective, (b) public, (c) repeatable and (d) honest.
>
> 135. Scientists publish their data and theories in recognized, refereed journals so that other scientists can evaluate and criticize their work.
>
> 136. Scientists rely only on empirical data that are accessible to others.
>
> 137. Scientists' tests, experiments and observations must be susceptible to duplication or verification by others.
>
> 138. Scientists' analyses must be in accord with the underlying data

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sign. To be forced to believe only one conclusion--that everything in the universe happened by chance--would violate the very objectivity of science itself." Letter from Dr. Wernher von Braun to Dr. Vernon Grose (Sept. 14, 1972).

750a. Quoted in S. Jaki*, Cosmos and Creator ____(1982).

and materials.

139. Scientists do not proceed according to dogmatic assumptions which are not subject to proof.

140. Scientists do not distort the views of other scientists or the ideas expressed in scientific literature by out-of-context misrepresentations.

141. Scientists do not use outdated or repudiated information because it conflicts with a preferred result.

142. Scientists do not alter scientific theory or change scientific terminology to meet legal or political advantage.750/

These alleged criteria, like the ACLU's definition of science, are contrived and are not regarded by philosophers of science as necessary or sufficient "methods of science". Moreover, although worthy objectives, they have historically been broken by scientists generally and evolutionists particularly, by major evolutionary "frauds",751/ evolu-

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750. Memorandum of Plaintiffs in Support of Summary Judgment at ___, Aguillard v. Edwards, No. 81-4787 (E.D. La., filed Dec. 3, 1981).

751. Haeckel* fraudulently misdrew his diagrams that were designed to prove the

tionist "misquotation",752/ and evolution-

"biogenetic law." _. Assmusth* & __. Hull, Haeckel's Frauds and Forgeries (1911). "Piltdown Man" was fraudulently constructed from a filed down ape jaw and fossil teeth, and was offered and accepted as a "missing link" between an ape-like ancestor and man. Straus*, The Great Piltdown Hoax, 119 Science 265 (1954); Oxnard*, Human Fossils: New Views of Old Bones, 41 American Biology Teacher 264 (1979). A more recent fraud involved a dolphin's rib offered as a hominid collarbone. Anderson*, Hominid collarbone exposed as dolphin's rib, 98 New Scientist 199 (April 28, 1983) ("He puts the incident on a par with two other embarrassing faux pas by fossil hunters: Hesperopithecus, the fossil pig's tooth that was cited as evidence of very early man in North America, and Eoanthropus or "Piltdown Man," the jaw of an orangutan and the skull of a modern human that were claimed to be the 'earliest Englishman'.")

752. Evolutionist scientist J. B. S. Haldane* significantly misquoted an author

*Note: Philosophers and scientists cited in this Section are not creationists, unless otherwise indicated; and their quoted statements are not intended as endorsements of creation-science. However, their quoted statements acknowledge concepts that creationist philosophers and scientists interpret as supporting the scientific nature of creation-science.

ist "suppression" or discounting of unfavor-

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in reviewing his book:

> Evolutionist J. B. S. Haldane, author of Science and Ethics, reviewed the book in the New Statesman and Nation for November 11, 1950. Haldane misquoted Velikovsky, then ridiculed the misquotation; he mismatched dates and the events Velikovsky had associated with them; he concluded that the book was "equally a degradation of science and religion."

The Velikovsky Affair: Scientism vs. Science 31-32 (A. de Grazia, R. Juergens* & L. Stecchini eds. 1966). Stanley Edgar Hyman* quoted Darwin totally out of context:

> Every fool has greeted Darwin's theory, as earlier fools have greeted earlier evolutionary theories, with the statement that it would make a man a descendant of a baboon or chimpanzee. He [Darwin] writes: 'But we must not fall into the error of supposing that the early progenator of the whole Simian stock, including man, was identical with, or even closely resembled, any existing monkey or ape.'

S. Hyman*, Darwin for Today 9 (1963). What Darwin* actually said in that passage was:

> But a naturalist would undoubtedly have ranked as an ape or monkey an ancient form which possessed many characters common to the Catarrhine and Platyrrhine monkeys, other characters in as intermediate condition, and some few, perhaps, distinct from those now found in either group. And as man from a genealogical point of view belongs

able data.753/ Most importantly, methodo-

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to the Catarrhine or Old World stock, we must conclude, however much the conclusion may revolt our pride, that our early progenitors would have been thus designated.

Only after this context did Darwin* make the statement quoted out of context by Hyman*. Accord, The Velikovsky Affair: Scientism vs. Science 27 (A. de Grazia, R. Juergens & . Stecchini eds. 1966) ("Neugebauer specified that Velikovsky had substituted the figure 33°14' for the correct value, 3°14', in a quotation from the work of another scholar. When Velikovsky protested in a letter to the late George Sarton, then editor of Isis, that the figure given in his book was correct and the 33°14' was in fact Neugebauer's own insertion, not his, Neugebauer dismissed the incident as a "simple misprint of no concern". . . .").

753. Lipson* states:

In fact, evolution became in a sense a scientific religion; almost all scientists have accepted it and many are prepared to 'bend' their observations to fit in with it.

Lipson*, A Physicist Looks at Evolution, 31 Physics Bulletin 138, 138 (1980). Accord, L. Eiseley*, The Immense Journey 18 (1957) ("At all events after it had passed under many eyes, interest waned, largely because the jaw was modern in appearance. . . . Since there was nothing about it that the anatomist would surely regard as primitive, interest quickly faded. Only time will tell how many other ancient human relics have been discarded simply because they did not

logy is generally not viewed by philosoph-

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fit a preconceived evolutionary scheme."); Romer*, The Early Evolution of Fishes, 2 Quarterly Review of Biology 1, 35 (1946) ("There remained, however, a large number of Paleozoic fossils . . . which did not fit well into the general evolutionary picture nor into any familiar group. . . . A common solution was to ignore them. . . . They were in general treated rather as appendages to the recognized groups, as undesirable excrescences on an otherwise well-rounded evolutionary structure."); F. Weidenreich*, Apes, Giants, and Men 47 (1946) ("This is a striking example of the extent to which paleontological facts are disregarded and replaced with purely speculative constructions when the evolution of man was the topic and when facts did not agree with preconceived ideas.") id. at 6-7 ("But Huxley placed more emphasis on similarities in his illustration than dissimilarities, because he wanted to show that the organization of the human skeleton is, in principle, that of an anthropoid. Therefore he depicted the great apes in an 'erect' position but man in not a completely erect one."); 1 A. Keith*, The Antiquity of Man xi, (1929) ("If human remains were found in one of the older Pleistocene deposits, and they proved to be modern in size and shape, they were rejected as spurious antiques, no matter what the state of their fossilization might be. On the other hand, if these remains proved unmodern in character, then they were accepted as genuinely old, even if only imperfectly fossilized. It seemed to me then, as it does now, that, in this matter,

ers of science as part of the demarcation between science and non-science.754/

Summary. Thus, the ACLU definition of science, and the McLean definition based on it, should not be adopted, because those definitions entail imposing a particular definition of science that is not shared by most philosophers of science onto the philosophical and scientific community. Because this definition is not the exclusive definition of science, and because it may be tactically formulated, it should not be adopted or followed, as the following Sections discuss. This is a material factual issue.

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the geologist's dice were so heavily loaded that it was scarcely possible for modern man to have a fair throw.").

754. Klemke*, Introduction, in Introductory Readings in the Philosophy of Science 1, 16-17 (E. Klemke, R. Hollinger & A. Kline eds. 1980) ("Second, nothing is said in this characterization about the method of obtaining knowledge or of obtaining laws. It may be induction, but it may also be a guess, intuition, hunch or whatever.")

(3) Erroneous and Tactically Contrived Definition of Science Adopted in the McLean Case

Overview. The McLean opinion gave the following definition of science:

> More precisely, the essential characteristics of science are:
> (1) It is guided by natural law;
> (2) It has to be explanatory by reference to natural law;
> (3) It is testable against the empirical world;
> (4) Its conclusions are tentative, i.e., are not necessarily the final word; and
> (5) It is falsifiable.755/

This definition is absolutely incorrect. It does not even resemble any definition of science existing in the philosophy of science literature, and has not been endorsed subsequently by any philosopher of science (except by certain ACLU witnesses from the McLean trial for tactical reasons). Instead, the McLean definition has been sharply cri-

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755. McLean v. Arkansas Board of Education, 529 F. Supp. 1255, 1267 (E. D. Ark. 1982).

ticized by such philosophers of science as Professor Larry Laudan* of Virginia Polytechnic Institute and Professor Barry R. Gross* of City University of New York. The definition in fact was contrived by the ACLU for the tactical purpose of excluding creation-science by definition from being scientific.756/ The following Sections

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756. Gross*, who is described in the biographical sketch as "one of the consultants to Skadden, Arps, Slate, Meagher, and Flom, plaintiffs' attorneys in McLean v. Arkansas," concedes that the McLean test is so incorrect as to prevent a favorable recommendation for an undergraduate, but then defends the five "requirements" because they are "sufficient to defeat Creationism":

> Philosophically, these [5 McLean] criteria may have been acceptable sixty or eighty years ago, but they are not rigorous, they are redundant, and they take no account of many distinctions nor of historical cases. The opinion does not state whether they are singly necessary or jointly sufficient. One would not recommend to graduate school a student who could do no better than this. Fortunately, Judge Overton and the litigators were not applying to graduate school. They were in a court

discuss these McLean criteria of science:

> (a) Natural law,
> (b) Falsifiability,
> (c) Testability, and
> (d) Tentativeness.

Laudan* describes the McLean definition as "remote from well-founded opinion in the philosophy of science,"757/ and gives the following general criticism of its definition of science (which should be read in view of his strong opposition to creation-science):

> of law. In this forum, confronted with Creationism and religious "know-nothingism" as adversaries, are these criteria so far off the mark? . . . Are they not sufficient to refute Creationism?

Gross*, Commentary: Philosophers at the Bar --Some Reasons for Restraint, in Science, Technology, and Human Values, Fall 1983 at 30, 36.

757. Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 19 (1982).

Once the dust has settled, however, the trial in general and Judge William R. Overton's ruling in particular may come back to haunt us; for, although the verdict itself is probably to be commended, it was reached for all the wrong reasons and by a chain of argument which is hopelessly suspect. Indeed, the ruling rests on a host of misrepresentations of what science is and how it works.

The heart of Judge Overton's Opinion is a formulation of "the essential characteristics of science." These characteristics serve as touchstones for contrasting evolutionary theory with Creationism; they lead Judge Overton ultimately to the claim, specious in its own right, that since Creationism is not "science," it must be religion.

. . ..

. . . The victory in the Arkansas case was hollow, for it was achieved only at the expense of perpetuating and canonizing a false stereotype of what science is and how it works. If it goes unchallenged by the scientific community, it will raise grave doubts about that community's intellectual integrity. No one familiar with the issues can really believe that anything important was settled through anachronistic efforts to revive a variety of discredited criteria for distinguishing between the scientific and the nonscientific.758/

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758. Id.

> [McLean] offered five "essential characteristics of science." I have shown that there are respectable examples of science which violate each of Overton's desiderata, and moreover that there are many activities we do not regard as science which satisfy many of them. 759/

He further describes the "unconscionable behavior" of those ACLU expert witnesses who "opportunistically" testified in favor of that definition:

> [S]everal scientists and philosophers have opportunistically suspended their usual critical faculties in order to act as if the demarcation between science and non-science is virtually unproblematic. As Henry Bauer's studies of Velikovsky and the Loch Ness Monster graphically illustrate, the idea seems to be that if one is dealing with a 'crank,' or even with the general public, one can expediently ignore the problematicity of the distinction and haul out whatever dogmatic obiter dicta about science are convenient for imposing a preferred solution on the situation. (Witness further the unconscionable behavior of many recent

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759. Laudan*, More on Creationism, in Science, Technology, and Human Values, Winter 1983, at 36, 37. We do not agree with Laudan's* definition of creation-science.

> critics of 'creation science,' whose testimony persuaded a federal judge that we know what 'the essential characteristics of science' are. . . .760/

A similar criticism of the five McLean criteria is given by Gross*, who argues that "they are not rigorous, they are redundant, and they take no account of many distinctions nor of historical cases," so that one "would not recommend to graduate schools a student who could do no better than this."761/ The falsifiability criterion has actually been questioned by Ruse*, the key philoso-

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760. Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology at 7, 30-31 (R. Laudan ed. 1983). He also states that the "invocation of such labels as 'scientific' or 'unscientific' runs the grave risk of intellectual dishonesty--unless it is made quite clear that such labels are nothing more than short-hand allusions to a thorough epistemic critique of the doctrines so labelled." Id.

761. Gross*, Commentary: Philosophers at the Bar--Some Reasons for Restraint, in Science, Technology, and Human Values, Fall 1983, at 30, 36. However, he turns around and defends the five criteria on pragmatic and tactical grounds. Id.

phy witness for ACLU in the Arkansas case and this case.761a/

Further, it is not clear whether all or just one of the four McLean factors must be met for a concept to be scientific.762/ Requiring all would rule out much of modern-day science, and requiring one would rule out very little. Moreover, these factors are internally inconsistent: natural laws are not tentative, and falsifiability is not different from (but is a part of) testability. However, each element of the McLean definition is improper or inadequate,

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761a. Ruse*, A Philosopher at the Monkey Trial, 93 New Scientist 317, ___ (1982) ("I myself am not really that keen on falsifiability as a mark of science in the first place.").

762. Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, ___ (1982); Gross*, Commentary: Philosophers at the Bar --Some Reasons for Restraint, in Science, Technology, and Human Values, Fall 1983, at 30, 36.

as the following Sections demonstrate. These are material factual issues.

(a) Incorrect Requirement of Natural Law. The "guided by natural law" and the "explanatory by reference to natural law"763/ requirement of the McLean opinion has been criticized as "altogether inappropriate" as follows:

> I find the formulation in the Opinion to be rather fuzzy; but the general idea appears to be that it is inappropriate and unscientific to postulate the existence of any process or fact which cannot be explained in terms of some known scientific laws . . . . [T]his requirement is an altogether inappropriate standard for ascertaining whether a claim is scientific. For centuries scientists have recognized a difference between establishing the existence of a phenomenon and explaining that phenomenon in a lawlike

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763. "Natural laws" have been defined by the plaintiffs as "statements or mathematical formulations which describe regularities in nature and which do not require any supernatural intervention or processes." Brief of Defendants* at 53, Keith v. Louisiana Department of Education, No. 81-989B (M.D. La., filed Dec. 2, 1981).

> way. Our ultimate goal, no doubt, is to do both. But to suggest, as the McLean Opinion does repeatedly, that an existence claim . . . is unscientific until we have found the laws on which the alleged phenomenon depends is simply outrageous. Galileo and Newton took themselves to have established the existence of gravitational phenomena, long before anyone was able to give a causal or explanatory account of gravitation. Darwin took himself to have established the existence of natural selection almost a half-century before geneticists were able to lay out the laws of heredity on which natural selection depended. If we took the McLean Opinion criterion seriously, we should have to say that Newton and Darwin were unscientific; and, to take an example from our own time, it would follow that plate tectonics is unscientific because we have not yet identified the laws of physics and chemistry which account for the dynamics of crustal motion.764/

Thus, first, this natural laws requirement is "inappropriate" because it may be scientific to demonstrate the "existence of a phenomenon" even though it cannot be ex-

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764. Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology, and Human Values 16, 17-18 (1982).

plained as guided by natural laws. It is also inappropriate as an "essential characteristic of science" for several other reasons.

Second, the natural laws requirement rules out the existence or at least the occurrence of nonnaturalistic causes or phenomena, as Buchner and others recognize and defend:

> Natural laws are immutable. . . . The experience of more than a thousand years has pressed on observers the conviction of the immutability of natural laws . . . with such absolute certainty that not the least doubt can remain. . . . With the most absolute truth and with the greatest scientific certainty can we say this day: There is nothing miraculous in the world. . . . The ghost of a personal, universal spirit, interfering in natural processes, has long been banished from astronomy, physics, and chemistry. . . . The ignorant layman may believe in a personal god; but the scientist or educated layman . . . would place his reason below that of the simplest peasant, if he believed in such a one without foundation. . . . Belief in God is therefore almost confined at the present time to those so-called learned men who know scarcely anything

about natural processes. . . . Whatever theological interest or narrowminded pedantry can urge in opposition to this is controverted by the strength of the facts, which in this respect leave no room for any doubt.765/

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765. L. Buchner*, Force and Matter, (P. Eckler trans. 1891). Accord, Provine*, Implications of Darwin's Ideas on the Study of Evolution, 32 BioScience 501, 506 (1982) ("Here are the implications of this mechanistic view of life as I see them. First, except for purely mechanistic ones, no organizing or purposive principles exist in the world. There are no gods and no designing forces. The frequently made assertion that modern biology and the assumptions of the Judeo-Christian tradition are fully compatible is false. Second, there exist no inherent moral or ethical laws, no absolute guiding principles for human society."); Mayr*, The Nature of the Darwinian Revolution, 176 Science 981, 988 (1972) ("The natural causes postulated by the evolutionists completely separated God from his creation, for all practical purposes. The new explanatory model replaced planned teleology by the haphazard process of natural selection. This required a new concept of God and a new basis for religion. . . .

. . ..

It is now clear why the Darwinian revolution is so different from all other scientific revolutions. It required not merely the replacement of one scientific theory by a new one, but, in fact, the rejection of at least six widely held basic beliefs . . ..");

True science, by contrast, cannot by definition alone (not based on scientific data) either rule out or necessitate the occurrence of nonnaturalistic causes or phenomena,766/ but must be open to evidence on the issue, as Einstein* has acknowledged and von Braun (the late director of the NASA space program) has stated:

G. Chesterton, Orthodoxy 68 (1908) ("If a man believes in an unalterable natural law, he cannot believe in any miracle in any age."). This is further discussed in Section 3[b] (4) infra.

The argument that science and theology or metaphysics are mutually exclusive realms, so that scientific conclusions can have no implications for theology or metaphysics, is rejected by most scientists and is based on a particular theology (NeoOrthodoxy and other existential theology). Section 3[b](3) infra.

766. In other words, science cannot properly conclude either that nonnaturalistic causes or phenomena never occur or always are responsible for events, although it can properly prefer events which explanation is more plausible or nonnaturalistic causes or phenomena). This discussion does not equate nonnaturalistic events with miracles, but recognizes that categories of nonnaturalistic events exist other than miracles.

> While the admission of a design for the universe ultimately raises the question of a Designer (a subject outside of science), the scientific method does not allow us to exclude data which lead to the conclusion that the universe, life and man are based on design. To be forced to believe only one conclusion--that everything in the universe happened by chance--would violate the very objectivity of science itself . . ..
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> . . ..
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> The inconceivability of some ultimate issue (which will always lie outside scientific resolution) should not be allowed to rule out any theory that explains the interrelationship of observed data and is useful for prediction.767/

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767. Letter from Dr. Wernher von Braun to Dr. Vernon Grose (Sept. 14, 1972)(Director of NASA's Marshall Space Flight Center). Accord, S. Jaki*, Cosmos and Creator (1982) (Einstein said science must be resigned to recognize nonnaturalistic events even though it cannot study their cause further). Macbeth* makes a similar observation:

> Therefore it is important to note how [G. G. Simpson] excludes design as a matter of scientific principle and method: '. . . the progress of knowledge rigidly requires that no nonphysical postulate ever be admitted in connection with the study of physical phenomena. We do not know what is and what is not explicable in physical

Third, the natural laws criterion arbitrarily limits science to some data and explanations even if they are false. It requires science to insist on naturalistic explanations and to suppress nonnaturalistic explanations, even if the naturalistic ones are absolutely improbable and if the excluded nonnaturalistic ones are more plausible. Only faith in the nonexistence of nonnaturalistic causes can so limit science to false explanations by defining what may be more probably true explanations of the scientific realm768/ (as is the case with evo-

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terms, and the researcher who is seeking explanations must seek physical explanations only . . . .'

N. Macbeth*, Darwin Retried 126 (1971).

768. Jastrow* states:

[Scientists] believe that every event that takes place in the world can be explained in a rational way as the consequence of some previous event. If there is a religion in science, this statement can be regarded as its main article of faith.

R. Jastrow*, Until the Sun Dies 11 (1977).

lution769/).

Fourth, the natural laws requirement conflicts with the general scientific recognition of singularities (one of a kind events). Singularities sometimes are simply not explainable by natural laws but often are instead departures from natural laws, yet are recognized by modern science to have occurred770/ (and form an important part of evolution771/).

Fifth, this requirement ignores that theories of origins necessarily involve assumed past causes that are not still operative and that can only be presumed but cannot always be proved to have followed na-

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769. Section 2[e](1)(b) infra.

770. For example, the big bang of the big bang hypothesis is a singularity. Weisskkopf*, The Origin of the Universe, 71 American Scientist 473, 476 (1983); J. Silk*, The Big Bang 322-24 (1979); R. Wald*, Space, Time and Gravity: The Theory of the Big Bang 51 (1971). The origin of the first life within biochemical evolution was also a singularity.

771. Section 2[e](1)(b) infra.

tural laws. For example, origin of life experiments can only show "that some of the [natural] processes which they postulate might conceivably have happened, but not that they did actually happen in the real history of the earth," as Dobzhansky* observed.772/

Sixth, the natural laws criterion itself is based in a "faith in the order of nature," as the famous philosopher-mathematician Whitehead*, Einstein*, and others* have pointed out:

> Faith in reason is the trust that the ultimate natures of things lie together in a harmony which excludes mere arbitrariness. It is the faith that at the base of things we shall not find mere arbitrary mystery. The faith in the order of nature which has made

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772. T. Dobzhansky*, The Biology of Ultimate Concern 46, 46, (1967); Sagan*, _____, Exobiology 471 (C. Ponnamperuma ed. 1972); Hull*, Thermodynamics and Kinetics of Spontaneous Generation, 186 Nature 693, 694 (1960). Accord, Section 2[e](1)(a)(i) infra.

possible the growth of science is a particular example of a deeper faith. This faith cannot be justified by any inductive generalisation.773/

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773. A. Whitehead*, Science and the Modern World 18 (1925). Accord, A. Einstein*, Essays in Science 11 (____) ("Certain it is that a conviction, akin to religious feeling, of the rationality or intelligibility of the world lies behind all scientific work of a higher order."); Frank*, Einstein, Mach, and Logical Positivism, in 1 Albert Einstein: Philosopher-Scientist 269, 285 (P. Schilpp ed. 1959) (Einstein* said "To this [sphere of religion] there also belongs the faith in the possibility that the regulations valid for the world of existence are rational, that it is comprehensible to reason. I cannot conceive of a genuine scientist without that profound faith."); Kaufman*, Luminous Reputations, Science Digest, Jan 1981 at ____, 8 ("Like most scientists, Einstein included, I have an almost religious belief in a basic underlying order--a belief that natural forces are just manifestations of some deeper thing.").

This belief in the order of nature historically arises from a creationist base. S. Jaki*, _____; A. Whitehead*, Science and the Modern World 12-13 (1925); Foster*, The Christian Doctrine of Creation and the Rise of Modern Natural Science, 43 Mind 446, 448, 453, 465 (1934); L. Gilkey*, Maker of Heaven and Earth 110 (1959); Section 3[b](1) infra. It requires a foundation of metaphysical assumptions. Taylor*, A Scientist

Creationist scientists share this underlying belief with evolutionist scientists, but apply only o the usual rule of the "order of nature" rather than to the exclusive rule of the order of nature (which rules out by definition any nonnaturalistic causes or phenomena).

Seventh, the McLean criterion of "na-

Questions The Philosophers 35 Thought Magazine 255 (1960) ("The existence and nature of realitv as it is given and as the scientist sees it cannot but prompt further discussion of the old philosophical question of the nature of reality. The very possibility of science, of that concordance which becomes obvious through science, between our thoughts and nature, is not a scientific question but a philosophical one. All scientific demonstrations presuppose the existence of science and that about which the science is. Thus the very existence of science calls for metaphysical explanation."); Muelder*, The Development of American Philosophy 333 (W. Muelder & L. Sears eds. 1940) ("The special sciences are obliged to take for granted a number of most important propositions, because their ways of working afford no means of bringing these propositions to the test. In short, they always rest upon metaphysics.").

tural laws" itself does not meet the other three "essential characterisitics of science": the requirement is not testable, falsifiable, or tentatively held.

Eighth, the natural laws requirement is closely related to positivism and materialism, which are only particular minority viewpoints among philosophers of science and have been heavily criticized by the majority, as discussed above.774/

Finally, it is interesting to note that many evolutionist scientists such as Sagan* will allow for chances in the "laws of nature" at extraordinary times that fit the evolutionary viewpoint.775/

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774. Section 2[d](2) supra.

775. C. Sagan*, Cosmos 260 (1980) ("Scientists wonder about what happens in an oscillating universe at the cusps, at the transition from contraction to expansion. Some think that the laws of nature are then randomly reshuffled, that the kind of physics and chemistry that orders this universe represent only one of an infinite

A large portion of the scientific community acknowledges the existence of God and the possibility of intervention in nature contrary to natural laws,776/ although a large minority denies or questions the existence of God and by that faith rules out any intervention and any breach of natural laws (and that minority viewpoint is held by some ACLU expert witnesses), as pointed out below.777/ The widespread The-

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range of possible natural laws."); Leslie*, Cosmology, Probability, and the Need To Explain Life, in Scientific Explanation and Understanding 53, 54, 58 (N. Rescher ed. 1983) ("The hypothesis, remember, is that laws and/or initial conditions (a distinction which may be hard to draw) vary from universe to universe."); R. Jastrow*, God and the Astronomers 113-14 (1978) ("the world had a beginning under conditions in which the known laws of physics are not valid"); Weisskopf*, The Cricin of the Universe, 71 American Scientist 473, 479 (1983) ("not know at all what the laws of nature were"); Barrow* & Silk*, The Structure of the Early Universe, Scientific American, Apr. 1980, at 118, 118 ("unfamiliar physical principles").

776. Section 3[b](4) infra.

777. Id.

istic viewpoint is exemplified by Albert Einstein*, who wrote that "[t]his firm belief, a belief bound up with deep feeling, in a superior mind that reveals itself in the world of experience, represents my conception of God."778/ In fact, modern science arose from a foundation of Theism and belief in some divine intervention, as discussed below.780/

Summary. For these reasons, natural law is not a prerequisite to science, even though it indeed is a frequent characteristic of science. (However, creation-science and evolution are equally guided and explanatory under natural laws, as discussed below.781/) This is a material factual issue.

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778. A. Einstein*, Essays in Science 11 (19__).

780. Section 3[b](1) infra; note 773 supra.

781. Section 2[d](3)(a) infra.

(b) Incorrect Requirement of Testability. The "testable against the empirical world" requirement of the McLean definition of science has similarly been criticized as not a true distinguishing mark of science, by Lakatos*, an internationally renowned philosopher of science:

> One of the most important points one learns from studying research programmes is that relatively few experiments are really important. The heuristic guidance the theoretical physicist receives from tests and ' refutations' is usually so trivial that large-scale testing--or even bothering too much with the data already available--may well be a waste of time. In most cases we need no refutations to tell us that the theory is in urgent need of replacement: the positive heuristic of the programme drives us forward anyway. Also, to give a stern 'refutable interpretation' to a fledgling version of a programme is dangerous methodological cruelty. The first versions may even 'apply' to non-existing 'ideal' cases; it may take decades of theoretical work to arrive at the first novel facts and still more time to arrive at interestingly testable versions of the research programmes, at the stage when refutations are no longer forseeable in the light of the programme itself.

. . . .

> According to conservative conventionalism, experiments may have sufficient power to refute young theories , but not to refute old, established theories: as science grows , the power of empirical evidence diminishes.782/

The testing criterion, which comes from Popper's* approach, is also repudiated by Kuhn* of Princeton and others*:

> To rely on testing as the mark of a science is to miss what scientists mostly do and, with it, the most characteristic feature of their enterprise.783/

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782. 1 I. Lakatos*, The Methodology of Scientific Research Programmes 65, 105 (J. Worrall & G. Currie eds. 1978). Accord, id. at 6 ("The history of science refutes both Popper and Juhn: on close inspection both Popperian crucial experiments and Kuhnian revolutions turn out to be myths: what normally happens is that progressive research programmes replace degenerating ones.").

783. Kuhn*, Logic of Discovery or Psychology of Research?, in Criticism and the Growth of Knowledge 1, 10 (I. Lakatos & A. Musgrave eds. 1970). Accord, Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 17 (1982)("It is now widelv acknowledged that many scientific claims are not testable in isolation, but only when imbedded in a larger system of statements, some of whose consecuences can be submitted to test.").

Further, many parts of science are not testable, such as definitions784/ and aspects of all theories of origins.785/ Finally, the testability requirement is not itself testable, falsifiable, or tentative.

Summary. Thus, testability is not an "essential characteristic of science." (However, creation-science and evolution are equally testable, as discussed below.786/) This is a material factual issue.

(c) Incorrect Requirement of Falsifiability. Falsifiability789/ is a part of testability and not a separate criterion, as Popper*, its primary proponent, specifies:

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784. 1 I. Lakatos*, The Methodology of Scientific Research Programmes 144 (J. Worrall & G. Currie eds. 1978).

786. Section 2[e](2) infra.

789. "Falsifiability" is "refutability, or testability." Popper*, Science, Conjectures and Refutations, in Introductory Readings in the Philosophy of Science 23, (E. Klemke, R. Hollinger & A. Kline eds. 1980).

> Every genuine test of a theory is an attempt to falsify it, or to refute it. Testability is falsifiability; but there are degrees of testability; some theories are more testable, more exposed to refutation, than others; they take, as it were, greater risks.790/

Thus, in any event falsifiability should not be listed as a separate "essential characteristic of science" as the McLean opinion did. Falsifiability is not a prerequisite of science.

First, the majority of philosophers of science reject it as an "essential characteristic of science," including Lakatos*791/,

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790. Id. at 22. Accord, F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 3 (1979) ("testing by attempted falsification."); T. Dobzhansky*, F. Ayala* , G. Stebbins* & J. Valentine*, Evolution 476 (1977). The ACLU has agreed that falsifiability is not a separate criterion from testability. Brief of Defendants at 53-54, Keith v. Louisiana Department of Education, No. 81-989B (M.D. La., filed Dec. 2, 1981) (attached as Exhibit VII).

791. 1 I. Lakatos*, The Methodology of Scientific Research Programmes 3-4, 30 (J. Worrall & G. Currie eds. 1978).

Quine*792/, Kuhn*793/, Laudan*794, even

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792. Quine*, Two Dogmas of Empiricism, in From a Logical Point of View 20-46 (W. Quine ed. 1963).

793. He writes:

> But Sir Karl describes as 'falsification' or 'refutation' what happens when a theory fails in attempted application, and these are the first of a series of related locutions that again strike me as extremely odd. Both 'falsification' and 'refutation' are antonyms of 'proof'. They are drawn principally from logic and from formal mathematics; the chains of argument to which they apply end with a 'Q.E.D.'; invoking these terms implies the ability to compel assent from any member of the relevant professional community. No member of this audience, however, still needs to be told that, here a whole theory or often even a scientific law is at stake, arguments are seldom so apodictic. All experiments can be challenged, either as to their relevance or their accuracy. All theories can be modified by a variety of ad hoc adjustments without ceasing to be, in their main lines, the same theories.

Kuhn*, Logic of Discovery or Psychology of Research?, in Criticsm and the Growth of Knowledge 13, ___ (I. Lakatos & A. Musgrave eds. 1970).

794. Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology 7, 23 (R. Laudan ed. 1983). He states about the McLean decision:

> It simply will not do for the defenders

Ruse* (an ACLU witness)794a/ and others*795/. For example, Lakatos* rejects falsification as unrelated to the real world of practice of science:

> Is, then, Popper's falsifiability criterion the solution to the problem of demarcating science from pseudosci-

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of science to invoke philosophy of science when it suits them (e.g., their much-loved principle of falsifiability comes directly from the philosopher Karl Popper) and to dismiss it as "arrcane" and "remote" when it does not. However noble the motivation, bad philosophy makes for bad law.

Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 19 (1982).

794a. Ruse*, A Philosopher at the Monkey Trial, 93 New Scientist 317, ____ (1982) ("I myself am not really that keen on falsifiability as a mark of science in the first place.").

795. Hull*, Karl Popper and Plato's Metaphor, in 2 Advances in Cladistics 177, 189 (N. Platnick & V. Funk eds. 198). Even Ruse*, and ACLU expert witness, concedes that "[s]imple criteria that supposedly give a clear answer to every case--for example, Popper's single stipulation of falsifiability--will not do.") Ruse*, Response, in Science, Technology and Human Values, Fall 1982, at 19, 20.

ence? No. For Popper's criterion ignores the remarkable tenacity of scientific theories. Scientists have thick skins. They do not abandon a theory merely because facts contradict it. They normally either invent some rescue hypothesis to explain what they then call a mere anomaly or, if they cannot explain the anomaly, they ignore it, and direct their attention to other problems. Note that scientists talk about anomalies, recalcitrant instances, not refutations. History of science, of course, is full of accounts of how crucial experiments allegedly killed theories. But such accounts are fabricated long after the theory had been abandoned.796/

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796. 1 I. Lakatos*, The Methodology of Scientific Research Programmes 3-4 (J. Worrall & G. Currie eds. 1978). Accord, id. at 30 ("Is, then, Popper's falsifiability criterion the solution to the problem of demarcating science from pseudoscience? No. For Popper's criterion ignores the remarkable tenacity of scientific theories. Scientists have thick skins. They do not abandon a theory merely because the facts contradict it. They normally either invent some rescue hypothesis to explain what they then call a mere anomaly or, if they cannot explain the anomaly, they ignore it, and direct their attention to other problems. Note that scientists talk about anomalies, recalcitrant instances, not refutations. History of science, of course, is full of accounts of how crucial experiments allegedly killed theories. But such accounts are fabricated long after the theory had been abandoned.").

Other critics of Popper's* position have argued that there is no logical difference between supporting a theory through confirming occurrences or through absence of falsifying occurrences.797/ In addition, critics have argued that the history of science has generally been one of the confirmation of proposed explanations rather than the falsification of conjectures.798/

Second, some concepts that are universally viewed as scientific are simply not falsifiable, as Laudan* notes:

> Karl Popper's 'falsificationist' criterion . . . fares no better. Apart from the fact that it leaves ambiguous the scientific status of virtually

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797. A. Quinton*, Karl Raimund Popper, in 6 Encyclopedia of Philosophy 398, 399 (1972); W. Salmon*, The Foundation of Scientific Interference 26-27 (1967).

798. R. Harré*, The Philosophies of Science: An Introductory Survey 50 (1972). When a scientific concept is partially falsified, it need not be and historically has not been abandoned, but instead has been modified. Note 806 infra.

> every singular existential statement, however well supported (e.g., the claim that there are atoms, that there is a planet closer to the sun than the earth, that there is a missing link), it has the untoward consequence of countenancing as 'scientific' every crank claim which makes ascertainably false assertions.799/

Other nonfalsifiable scientific concepts include quantification, atomistic discreteness, hierarchical structure, and the principle of uniformity in nature.800/

Finally, although much of science does involve falsifiable occurrences, scientific study of origins involves nonrecurring past events with incomplete records, and the very nature of nonrecurring past events and limited records means that explanations of

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799. Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology 7, 23 (R. Laudan ed. 1983).

800. G. Holton*, Thematic Origins of Scientific Thought: Kepler to Einstein 29, 63 (1973).

origins may only be partially falsifiable.801/ It is possible for a scientific concept to be partially falsifiable and partially non-falsifiable.802/ Incidentally, Popper*, the architect of falsification analysis, argued that evolution is "not falsifiable" but is instead a "metaphysical research programme".804/ Of course, the falsification requirement is itself not falsifiable, testable, or tentative.

Summary. Thus, falsification is not a proper "essential characteristic of science."

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801. Section 2[e](3) infra.

802. See Moore*, Science as a Way of Knowing--Evolutionary Biology, 23 American Zoologist 1, 8-9 (1983); Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 17 (1982) ("It is now widely acknowledged that many scientific claims are not testable in isolation, but only when imbedded in a larger system of statements, some of whose consequences can be submitted to test.").

804. Popper*, Intellectual Autobiography, in 2 The Philosophy of Karl Popper 3, 134, 137 (P. Schilpp ed. 1974).

(In any event, creation-science and evolution are to the same extent falsifiable, as discussed below.804a/) This falsification question is a material factual issue.

(d) Tentativeness. The "tentativeness" or revisability requirement has similarly been criticized as not an "essential characteristic" of science, and in fact is not a characteristic at all of most of modern science.

First, science is ordinarily characterized by "the 'dogmatism' of 'normal science'" rather than by tentativeness, as Lakatos* and also Popper*, Laudan*, Kuhn*, and others* explicitly recognize:

> Popper is right in stressing that 'the dogmatic attitude of sticking to a theory as long as possible is of considerable significance. Without it we could never find out what is in a theory--we should give the theory up before we had a real opportunity of

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804a. Section 2[e](3) infra.

finding out its strength; and in consequence no theory would ever be able to play its role of bringing order into the world, of preparing us for future events, of drawing our attention to events we should otherwise never observe'. Thus the 'dogmatism' of 'normal science' does not prevent growth as long as we combine it with the Popperian recocnition that there is good, progressive normal science and that there is bad, degenerating normal science, and as long as we retain the determination to eliminate, under certain objectively defined conditions, some research programmes.805/

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805. 1 I. Lakatos*, The Methodology of Scientific Research Programmes 89-90 (J. Worrall & G. Currie eds. 1978). Laudan* similarly states:

> But historical and sociological researches on science strongly suggest that the scientists of any epoch likewise regard some of their beliefs as so fundamental as not to be open to repudiation or negotiation. Would Newton, for instance, have been tentative about the claim that there were forces in the world? Are quantum mechanicians willing to contemplate giving up the uncertainty relation? Are physicists willing to specify circumstances under which they would give up energy conservation? Numerous historians and philosophers of science (e.g., Kuhn,* Mitroff,* Feyerabend,* Lakatos*) have documented the existence of a certain degree of dogmatism about core commit-

Second, this dogmatism is normally appropriate as scientists "try to work around the falsifying data" rather than abandoning their theories, as Ruse* (an ACLU witness here) argues:

> [S]cientists have not thrown out their theories, simply because some of the facts were against them. They refused to let their theories be falsified.

> ments in scientific research and have argued that such dogmatism plays a constructive role in promoting the aims of science . . .. [O]ne does not even begin to get at those differences by pretending that science is characterized by an uncompromising open-mindedness.

Laudan*, Commentary, Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 17 (1982). Kuhn's* position is the same:

> The dogmatic attitude in science--which would explain its stable periods--was described by Kuhn as a prime feature of "normal science."

1 I. Lakatos*, supra at 90. Accord, G. Kerkut*, Implications of Evolution viii (1960) ("It is very depressing to find that many subjects are becoming encased in scientific dogmatism. The basic information is frequently overlooked or ignored and opinions become repeated so often and so loudly that they take on the tone of Laws.").

> And indeed, they ought to have so refused. If a scientist threw out his (or her) theory as soon as something went wrong, as soon as the facts told against the theory, very little science would get done. Often, if not normally, the proper scientific strategy is to continue with the theory, and to try to work around the falsifying data--by showing the data not to be at all what it appears, by inventing ad hoc hypotheses to explain away the data, or if worse comes to worst, by ignoring the data and hoping that some day it will go away.806/

Third, "whether a body of reasoning is scientific or not should be decided independently of the question of whether the adherents are committed to one ideology or

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806. Ruse*, Falsifiability, Concilience and Systematics, 28 Systematic Zoology 530, ___ (1979). Accord, 1 I. Lakatos*, The Methodology of Scientific Research Programmes 48 (J. Worrall & G. Currie eds. 1978) ("Instead, we must use our ingenuity to articulate or even invent 'auxiliary hypotheses', which form a protective belt around this core, and we must redirect the modus tollens to these. It is this protective belt of auxiliary hypotheses which has to bear the brunt of tests and get adjusted and readjusted, or even completely replaced, to defend the thus-hardened core.").

another," as Raup* argues.807/ This is the classic philosophic distinction between the source and the justification of a concept, which is discussed below.807a/

Finally, the tentativeness criterion contradicts the natural laws criterion, because natural laws are never tentatively held (or they would not be "laws"), and theories are also not tentatively held (or they would be hypotheses instead). Similarly, the tentativeness criterion is not itself tentative or falsifiable or testable.

Summary. Thus, tentativeness is not

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807. Raup*, The Geological and Paleontological Arguments of Creationism, in Scientists Confront Creationism 147, 159 (L. Godfrey ed. 1983). Accord, Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology & Human Values 16, 17 (1982) ("Even worse, the charge of dogmatism . . . egregiously confuses doctrines with the proponents of those doctrines. . . . [I]t is quite irrelevant whether they themselves are closeminded.") (speaking of creationists).

807a. Section 3[c](2)(b) infra.

an "essential characteristic"--or a characteristic at all--of science. (However, if it is, creation-science meets a tentativeness requirement more than evolution does, as discussed below.808/) This is a material factual issue.

Conclusion. The McLean definition of science is incorrect and rejected by most philosophers of science in every point, and is internally inconsistent and redundant. "If it goes unchallenged by the scientific community, it will raise grave doubts about that community's intellectual integrity," in the assessment of one noted philosopher of science.809/ However, even if the McLean definition is accepted, creation-science conforms to it to the same extent that evo-

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808. Section 2[e](4) infra.

809. Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology & Human Values 16, 19 (1982).

lution does, as discussed in Section 2[e] below. The McLean definitional problems are material factual issues.

(4) Inconclusiveness of the Majority Assessment by Scientists

Overview. With the various definitions of science in mind, an important question is who is to apply those definitions. The most frequent answer is the "community of scientists" or the "community of philosophers of science."

The next question is what part of that community makes the determination if the community is not unanimous. The answer should not be a numerical majority, for several reasons. The following Sections discuss:

(a) Significance of minority opinions in the scientific community, (b) "Bias" of the scientific community in general,

(c) "Bias" of the scientific community in favor of evolution, and
(d) "Intolerance" of the scientific community against creation-science.

These are material factual issues.

(a) Significance of Minority Opinions in the Scientific Community. The scientific community has been defined as follows:

> A scientific community consists, in this view, of the practitioners of a scientific specialty. . . . For these major communities group membership is readily established, except at the [disciplines'] fringes. [1] Subject of highest degree, [2] membership in professional societies and [or] [3] journals read are ordinarily more than sufficient.811/

Satisfaction of two of these three factors is ordinarily sufficient to place an individual in the scientific (or philosophic) community.

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811. Kuhn*, Second Thoughts on Paradigms, in The Structure of Scientific Theories 459, 461-62 (F. Supp 2d ed. 19__).

The scientific nature and correctness of a concept cannot properly be decreed by the majority in the scientific (or philosophic) community:

> This truly democratic principle has led to the fallaciously democratic practice of determining the validity of a scientific view by finding how many other scientists agree with it. Voting in this context is so much influenced by past training and indoctrination that it tends to reject the new and to reaffirm the old.812/

The professional opinions of the minority are important and should be expressed rather than suppressed, even if they are "scientific heresies":

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812. L. Margolis*, Origin of Eukaryotic Cells, _____ (1970). Accord, Feyerabend*, The Expert as Con Man, 92 Science Digest 83 (1983) ("There are, of course, areas in which scientists agree--but this cannot raise our confidence. Unity is often the result of a political decision. On other occasions, it is the result of shared prejudices. Or it may indicate a decrease in critical consciousness; criticism remains faint if only one point of view is considered.").

> It would seem a good principle to encourage the study of 'scientific heresies.' There is always the danger that a reader might be seduced by one of these heresies but the danger is neither as great nor as serious as the danger of having scientists brought up in a type of mental strait-jacket or of taking them so quickly through a subject that they have no time to analyse and digest the material they have 'studied.'813/

Nearly every current scientific majority view was once a minority v iew, and most past majority viewpoints in the history of science have been abandoned.814/ The dan-

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813. G. Kerkut*, Implications of Evolution 157 (1960).

814. Rosen*, Book Review, 27 Systematic Zoology 370, 371 (1978) ("One need hardly point out that popularity was also a characteristic of the phlogiston theory, Ptolemaic cycles and epicycles, the ether as an explanation for wave transmissions in a vacuum, and those ideas of 19th-century Europe that preceded natural selection theory--the miasma or noxious vapors (Rogers, 1973)--to explain evolutionary change."); P. Bridgeman*, The Way Things Are 129 (1959) ("Some people go so far as to define science as the consensus of all competent observers. This, it seems to me, goes too far and misplaces the emphasis. . . . 'Competent persons' at any epoch means those who at that

gers of suppressing a scientific minority viewpoint are evident in the "bizarre incident" of suppression of Mendelian genetics in the Soviet Union.815/ Yet the benefits

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epoch have been subjected to a definite preconditioning. . . . It does not preclude the possibility that all competent persons ar e reacting incorrectly because of some feature of contemporary culture, and there are examples, as Weierstrass in mathematics, where consensus was ultimately shown to have been wrong."); see also E. Radl*, The History of Biological Theories (1930).

815. W. Stansfield*, The Science of Evolution 31 (1977) ("His name was Trofim D. Lysenko. In one of the most bizarre incidents in the history of biology, this man gained the confidence and backing of the Central Committee of the Communist Party through his association with Premier Stalin. It was decreed that the Lysenko style of biology, genetics, and especially agriculture be adopted throughout the country. Needless to say, the folly of pursuing an erroneous theory led to disastrous effects on Russia's agricultural productivity and thoroughly disrupted its progress in basic biological research for almost two decades. In 1965 Lysenko was demoted from his positions of authority and genetics once again became a respectable science."); 1 I. Lakatos*, The Methodology of Scientific Research Programmes 7 (J. Worrall & G. Currie eds. 1978) ("The Central Committee of the Soviet Communist Party in 1949 declared

of minority scientific views are sometimes threatened by majority bias.

(b) "Bias" of the Scientific Community in General. The scientific (and philosophic) community has always had strong majority biases, which make it improper to apply the definitions of science to particular concepts by a scientific majority vote. The effect of a theory is to color perceptions as fact, as Eldredge* and Gould* (an ACLU witness) stress:

> (1) The expectations of theory color perception to such a degree that new notions seldom arise from facts collected under the influence of old pictures of the world. New pictures must cast their influence before facts

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Mendelian genetics pseudoscientific and had its advocates, like Academician Vavilov, killed in concentration camps . . . ."); Joravsky*, The Lysenko Affair, Scientific Am., Nov. 1962, at 41. Suppression of minority scientific viewpoints continues. M. Popovsky*, Manipulated Science: The Crisis of Science and Scientists in the Soviet Union Today xiii (1979).

can be seen in different perspective.816

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816. Eldredge* & Gould*, Punctuated Equilibria: An Alternative to Phyletic Gradualism, in Models in Paleobiology at 82, 83 (J. Schopf ed. 1972). Accord, J. Robinson*, Early Hominid Posture and Locomotion 212 (1972) ("The conceptual framework within which a student works shapes the viewpoint from which he approaches the material being studied and powerfully influences the conclusions that he draws."); T. Kuhn*, The Structure of Scientific Revolutions 97 (2d ed. 1970) ("Paradigms provide all phenomena except anomalies with a theory-determined place in the scientist's field of vision.").

All scientists have metaphysical presuppositions about reality and science:

> It seems clear that everybody has got some kind of metaphysics, even if he thinks he hasn't got any. Indeed, the practical "hard-headed" individual who "only goes by what he sees" generally had a very dangerous kind of metaphysics, i.e., the kind of which he is unaware. . . . Such metaphysics is dangerous because, in it, assumptions and inferences are being mistaken for directly observed facts, with the result that they are effectively riveted in an almost unchangeable way into the structure of thought.

Rohm*, Some Remarks on the Notion of Order, in 2 Towards a Theoretical Biology ___, 42, (C. Waddington ed. 1969). Accord, H. Hein*, On the Nature and Origin of Life 93 (1971) ("on the whole our metaphysical commitment has priority over our scientific and common-

The impact of a widely held theory is often to foster intolerance of minority scientific views, as Brady* points out:

> When a theory becomes part of the common working knowledge of an entire community it becomes the context within which that community understands the world. Doubt comes to be regarded as something less than legitimate, and critics find themselves talking only to each other. The critic is, in a certain sense, self-exiled, for he or she is trying to question what the common language of the field takes for granted, and this linguistic hurdle is a difficult one to overcome. Yet for the critic, the task is merely one of clarification. The other side, however, must deal with a condition which may turn out, in the end to be far more debilitating, i.e. belief.817/

One such bias is the "mechanistic materi-

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sense beliefs such that, if challenged, they will yield to it rather than the reverse.").

817. Brady*, Dogma and Doubt, 17 Biological Journal of the Linnaean Society 79, 79 (1982). Solzhenitsyn notes the "dangerous tendency" to form a herd, shutting off successful development, "among researchers." Solzhenitsyn, "A World Split Apart", Commencement Address at Harvard University (1978).

alist philosophy explicitly or implicitly shared by most of the present 'establishment' in the biological sciences," as Dobzhansky* and others* have acknowledged.818/ Another such bias is evolution, as discussed in the next Section.

One example of scientific bias and intolerance toward a minority scientific viewpoint is ridicule of continental drift, which Gould* describes:

> During the period of nearly universal rejection, direct evidence for continental drift--that is, the data

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818. Dobzhansky*, A Biologist's World View, 175 Science 49, 49 (1972). Accord, W. Dampier-Whetham*, A History of Science 445 (1951) ("At the beginning of the twentieth century the majority of men of science held unconsciously a naive materialism"); see F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 238 (1983) ("the anticlerical bias of modern science"); Watkins*, Against 'Normal Science', in Criticism and the Growth of Knowledge 33, ____(I. Lakatos & A. Musgrave eds. 1970) ("a significant parallelism between science, especially Normal Science, and theology").

> gathered from rocks exposed on our continents--was every bit as good as it is today. It was dismissed because no one had devised a physical mechanism that would permit continents to plow through an apparently solid oceanic floor. In the absence of a plausible mechanism, the idea of continental drift was rejected as absurd. The data that seemed to support it could always be explained away. . . . In short, we now accept continental drift because it is the expectation of a new orthodoxy.819/

A second example is active suppression of the minority scientific viewpoint expressed by Velikovsky*:

> What must be called the scientific establishment rose in arms, not only against the new Velikovsky theories but against the man himself. Efforts were made to block dissemination of Dr. Velikovsky's ideas, and even to punish supporters of his investigations. Universities, scientific societies, publishing houses, the popular press were approached and threatened; social pressures and professional sanctions were invoked to control public opinion.
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> Prominent American scientists, roused

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819. Gould*, The Continental Drift Affair, Natural History, ___ at ___ , ____.

> to indignation even before the book was published, greeted it with a remarkable demonstration of ill will that included a partially successful attempt to suppress the work by imposing a boycott on its first publisher's textbooks. The reading public witnessed the unique spectacle of a scientific debate staged not in the semi-privacy of scientific meetings and journals, but in the popular press, with scientists--in rare accord--on one side and lay champions of free speech on the other. . . . Velikovsky and his book were discredited in the public eye.
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> From the start there was more to the controversy than the simple question of a dissenting scholar's right to be published and read: the atmosphere generated by scientific consternation was charged with a peculiar emotion that Newsweek termed "a highly unacademic fury."820/

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820. The Velikovsky Affair: Scientism vs. Science 1, 7 (A. de Grazia, R. Juergens & L. Stecchini eds. 1966). This shower of majority scientific bias included efforts to prevent publication of a book:

> Velikovsky was summoned to Brett's office and told that professors in certain large universities were refusing to see Macmillan salesmen, and letters demanding cessation of publication were arriving from a number of scientists. Brett beseeched Velikovsky to save him from disaster by approving an arrangement that had been tentative-

A third example is active supression of creation-science, as discussed below.

(c) "Bias" of the Scientific Community in Favor of Evolution. The majority of the scientific community is strongly biased in favor of evolution, as Patterson* observes:

> ly worked out with Doubleday & Company, which had no textbook department. . . . Brett showed Velikovsky a letter from Michigan Astronomer Dean B. MacLauchlin, who insisted Velikovsky's book was nothing but lies. On the same page McLaughlin averred he had not read and never would read the book.

Id. at 26. It also included rejection by a scientific journal (Science, published by the American Association for the Advancement of Science) without even reading the article:

> Velikovsky sought to publish a paper showing that the points brought out in that letter were but a few among many other ideas set forth in his books that have already been supported by independent research. The attempt was in vain; Philip Abelson, the editor of Science, returned Velikovsky's paper without reading it and published instead a facetious letter from a Poul Anderson.

Id. at 46-47.

> Popper warns of a danger: 'A theory, even a scientific theory, may become an intellectual fashion, a substitute for religion, an entrenched dogma'. This has certainly been true of evolutionary theory.821/

The dogmatism (rather than tentativeness) of this majority position is described below.822/ Many scientists and philosophers have described evolution as effectively a "scientific religion," such as philosopher Grene*:

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821. C. Patterson*, Evolution 150 (1977). Accord, Brady*, Dogma and Doubt, 17 Biological Journal of the Linnaean Society 79, 95-96 (1982) ("What is at stake is not the validity of the Darwinian theory itself, but of the approach to science that it has come to represent. The peculiar form of consensus the theory wields has produced a premature closure of inquiry in several branches of biology, and even if this is to be expected in 'normal science', such a dogmatic approach does not appear healthy."); T. Dobzhansky*, Evolutionary and Population Genetics, 142 Science 1131, 1134 (1963) ("Its acceptance is nevertheless so wide that its opponents complain of inability to get a hearing for their views."); F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution ___ (1983)(evolution is a "new dogma").

822. Section 2[e](4)(b) infra.

> It is as a religion of science that Darwinism chiefly held, and holds men's minds. . . .
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> . . ..
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> The modified, but still characteristically Darwinian theory has itself become an orthodoxy, preached by its adherents with religious fervor and doubted, they feel, only by a few muddlers imperfect in scientific faith.823/

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823. Grene*, The Faith of Darwinism, Encounter, Nov. 1959, at 48, 48-49. Accord, Lipson*, A Physicist Looks at Evolution, 31 Physics Bulletin 138, 138 (1980) ("In fact, evolution became in a sense a scientific religion; almost all scientists have accepted it and many are prepared to 'bend' their observations to fit in with it."); S. Jaki*, Cosmos and Creator __ (1982)("Darwinism is a creed not only with scientists committed to document the all-purpose role of natural selection. It is a creed with masses of people who have at best a vague notion of the mechanism of evolution as proposed by Darwin, let alone as further complicated by his successors."); N. Macbeth*, Darwin Retried 126-27 (1971) ("Darwinism has itself become a religion."); E. Conklin*, Man Real and Ideal 147 (1943)("The concept of organic evolution is very highly prized by biologists, for many of whom it is an object of genuinely religious devotion, because they regard it as a supreme integrative principle. This is probably the reason why severe methodological criticism employed in other departments of biology has not yet been brought to bear on evolutionary speculation.").

The consequence of questioning evolution is that the dissenter "inevitably attracts the speculative psychiatric eye to himself," as well as an "attack with quite remarkable ferocity," in the words of biologist Hardin* and philosophers Saunders* and Ho*:

> [T]he work of those who are less cautious in this regard is sometimes attacked with quite remarkable ferocity by critics who see in it nothing but a perverse refusal to accept a theory whose validity they believe has been established beyond any reasonable doubt.824/

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824. G. Hardin*, Nature and Man's Fate 216 (1961) Saunders* & Ho* state that "the work of those who are less cautious in this regard is sometimes attacked with quite remarkable ferocity by critics who see in it nothing but a perverse refusal to accept a theory whose validity they believe has been established beyond any reasonable doubt." Saunders* & Ho*, Is Neo-Darwinism Falsifiable?--And Does It Matter?, 4 Nature and System 179, 192 (1982). Accord, J. Rifkin*, Algeny 119-20 (1983) ("The ferocity with which many evolutionists set forth their views and the high level of intolerance they demonstrate toward alternative frames of reference should be cause enough for pause, if not alarm.").

This evolutionary bias has caused paleontologists to wear "blinders" and to "ignore" data in conflict with neo-Darwinian biological evolution,825/ and has produced "vir-

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825. Gould* & Eldredge*, Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered, 3 Paleobiology 115, 116, 117 (1977) ("[P]aleontologists have worn blinders that permit them to accumulate cases in one category only; they have sought evidence of slow, steady and gradual change as the only true representation of evolution in the fossil record (Eldredge and Gould 1972). Two other classes of information were explained away or simply ignored: 1) morphological gaps in stratigraphic sequences--which might have suggested a punctuational view of evolution--were attributed to imperfections of the fossil record; 2) evolutionary stasis, though recognized by all and used by stratigraphers in the practical work of our profession, was ignored by evolutionists as "no data."). Accord, Eldredge*, An Extravagance of Species, Natural History, July 1980, at 47, 50 ("But for years the apparent lack of progressive change within fossil species has been ignored or else the evidence--not the theory--has been attacked."); Zihlman* & Lowenstein*, False Start or the Human Parade, Natural History, Aug. 1979, at 86, 90 ("But these same scholars have almost universally, and sometimes emotionally, rejected the findings of molecular evolution, primarily because these challenge,

ulence" in opposition to the transformed cladistic approach.826/ Evolutionary bias has also confronted new ideas about cosmic evolution and biochemical evolution.827/

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indeed, refute, the claim that Ramapithecus was the ancestral human."); Gould* & Eldredge*, supra at 115 ("Phyletic gradualism was an a priori assertion from the start--it was never 'seen' in the rocks; it expressed the cultural and political biases of 19th century liberalism."); Pilbeam*, Rearranging Our Family Tree, Human Nature, June 1978, at 39, 45 ("I know that, at least in paleoanthropology, data are still so sparse that theory heavily influences interpretations. Theories have, in the past, clearly reflected our current ideologies instead of the actual data . . ..").

826. Patterson*, Cladistics 27 Biologist 234, 234, ___ (1980) ("Yet whenever and wherever cladistics is discussed, there is controversy. The virulence of this controversy and the partisan feelings evoked are remarkable in so old and apparently harmless a discipline as systematics; there has hardly been such bad temper in biology since the violent arguments provoked 120 years ago by Darwin's theory of evolution by natural selection.").

827. R. Jastrow*, God and the Astronomers 16 (1978) ("Theologians generally are delighted with the proof that the Universe had a beginning, but astronomers are curiously upset. Their reactions provide an

Meanwhile, philosophers of science remind us "that the mathematical probability of all theories . . . given any amount of evidence is zero."828/ The bias that confronts

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interesting demonstration of the response of the scientific mind--supposedly a very objective mind--when evidence uncovered by science itself leads to a conflict with the articles of faith in our profession. It turns out that the scientist behaves the way the rest of us do when our beliefs are in conflict with the evidence. We become irritated, we pretend the conflict does not exist, or we paper it over with meaningless phrases."); M. Simon*, The Matter of Life 166 (1971) ("Scientists can become so impressed by the possibilities of building up a hypothetical historical picture of the origins of life at all that they may be prone to ignore or to underemphasize logical difficulties and matters of detail.").

828. 1 I. Lakatos*, The Methodology of Scientific Research Programmes 3 (J. Worrall & G. Currie eds. 1978). Accord, Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology at 7, 27 (R. Laudan ed. 1983) ("There seems good reason, drawn from the history of science to suppose that most scientific theories are false; under the circumstances, how plausible can be the claim that science is the repository of all and only well-confirmed theories?"); J. Sullivan*, The Limitations of Science 141-62 (1933)("it is highly probable that all scientific theories are wrong.").

any questioning of evolution is magnified against an y advocacy of creation-science.

(d) "Intolerance" of the Scientific Community against Creation-Science. Most of the scientific community is "intolerant" of creation-science, as Provine* (a prominent historian of science at Cornell) observes:

> [M]ost biological scientists are intoleran t of creationism and do not understand the reasons for the great attraction of the creationist's position.829/

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829. W. Provine*, Theories of Creationism and Evolution from a Historical Perspective (unpublished lecture before Sigma Xi Chapter, Corning, N.Y. Nov. 17, 1981). Accord, Patterson*, An Engineer Looks at the Creationist Movement, 89 Proc. Iowa Academy of Sciences _____, 57 (1982) ("Were biologists, geologists, or paleontologists to endorse publicly a pseudoscience such as creationism their chances of achieving or retaining prestigious academic positions would be greatly undermined, as would their chances for high office in professional societies. Only in Bible colleges, seminaries, and creationist ministries can the latter succeed as outspoken creationists.").

This prejudice frequently reaches the point of discrimination against creationist scientists or students in public universities and schools (as discussed below),830/ and even of denials that creationist scientists with earned Ph.D. degrees in science and professorships in science are "scientists" and members of the "scientific community."831/ Such a scientific majority cannot fairly apply definitions of science to creation-science.

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830. Section 4[d] infra.

831. Shafersman*, the president of the anti-creationist Committee on Education in Evolutionary Biology (formerly Committee of Correspondence) for Texas, has written and a geological journal has published the following:

> I dispute Henry Morris's claim that thousands of scientists are creationists. No scientist today questions the past and present occurrence of evolution in the organic world . . .. Those 'thousands of creationists' with legitimate post-graduate degrees and other appropriate credentials are not scientists, precisely because they have abandoned the scientific method

Summary. Scientists, although striving for objectivity, have acknowledged biases, particularly on the part of a scientific majority in favor of evolution and against creation-science. Thus, the scientific community (or philosophical community) is not able to apply definitions of science ob@ectively to creation-science. These are material factual issues.

Conclusion. Creation-science, involving the empirical evidence and scientific interpretations discussed above, is scientific under all of the above definitions of science, except possibly under the question-

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and the scientific attitude, criteria far more crucial to the definition of scientist than the location or duration of one's training or the identity of one's employer.

Schafersman*, _____, Geotimes, Auc. 1981, at 11, _____. Accord, Deposition of Michael Ruse* at _____, Keith v. Louisiana Department of Education, No. 81-989B (M.D. La., filed Dec, 2, 1981).

able definition of positivism and naturalism (under which evolution is to the same extent not scientific). Even if the erroneous and contrived ACLU definition that was adopted in McLean is accepted, however, creation-science meets that definition just as well as evolution does, as discussed in the next Section. These are material factual issues.

e. Material Factual Issue that Creation-Science and Evolution Equally Meet the McLean Definition of Science

> The fact of evolution is the backbone of biology, and biology is thus in the peculiar position of being a science founded on an unproved theory--is it then a science or a faith? Belief in the theory of evolution is thus exactly parallel to belief in special creation--both are concepts which believers know to be true but neither, up to the present, has been capable of proof.
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> --Mathews*, Introduction to The Origin of Species834/

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834. Mathews*, Introduction to The Origin of Species, x-xi (1974).

*Note: Philosophers and scientists cited in this Section, unless otherwise indicated, are not creationists, and their quoted statements are not intended as endorsements of creation-science. However, their quoted statements are acknowledging concepts that creationist philosophers and scientists interpret as supporting creation-science better than evolution.

Darwin* acknowledged that the "theory of creation" is scientific; he merely regarded it as incorrect science.835/ Laudan*, professor of philosophy of science at Virginia Polytechnic Institute (and an ardent opponent of creation-science), concludes that creation-science "manifestly does"836/ meet the definition of science in the McLean opinion:

> At various key points in the Opinion, Creationism is charged with being untestable, dogmatic (and thus nontentative), and unfalsifiable. All three charges are of dubious merit.
> . . . .
> [I]t can be argued that creationism already satisfies these requirements 837/

On the other hand, Popper*, the internation-

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835. C. Darwin*, The Origin of Species 455 (1963).

836. Laudan*, More on Creationism, in 8 Science, Technology & Human Values 36, 36 (1983). We do not agree with all aspects of Laudan's* definition of creation-science.

837. Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology & Human Values 16, 16, 18 (1982).

ally famous philospher of science, and others have concluded that evolution itself does not meet the definition of science used in McLean:

> 37. Darwinism as a Metaphysical Research Programme
>
> From this point of view the question of the scientific status of Darwinian theory--in the widest sense, the theory of trial and error elimination--becomes an interesting one. I have come to the conclusion that Darwinism is not a testable scientific theory, but a metaphysical research programme--a possible framework for testable scientific theories.
>
> . . ..
>
> Now to the degree that Darwinism creates the same impression, it is not so very much better than the theistic view of adaptation; it is therefore important to show that Darwinism is not a scientific theory, but metaphysical.838/

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838. Popper*, Intellectual Autobiography, in 2 The Philosophy of Karl Popper 3, 134, 137 (P. Schilpp ed. 1974) Patterson* reaches the same conclusion:

> 12.4 So, at present, we are left with neoDarwinian theory: that evolution has occurred, and has been directed mainly by natural selection, with random contributions from genetic drift, and perhaps the occasional

In either case, creation-science and evolution are parallel to the McLean definition.

Summary. The McLean definition of science, although it is erroneous and "remote from well-founded opinion in the philosophy of science,"839/ indeed is equally met by

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hopeful monster. In this form, the theory is not scientific by Popper's standards. Indeed, Popper calls the theory of evolution not a scientific theory but 'a metaphysical research programme'.

C. Patterson*, Evolution 149 (1978). Accord, Cartmill*, Hypothesis Testing and Phylogenetic Reconstruction, in Zeitschrift fur Zoologische Systematik und Evolution: forschung, 73, 90 (1981) ("Phylogenetic reconstruction is possible. However, Popperian phylogenetic reconstruction apparently is not. It follows that the study of phylogeny is not, by Popper's criteria, a science at all."); Ghiselin*, On Paradigms and the Hypermodern Species Concept, 27 Systematic Zoology 437, 437-38 (1978) ("He read a work by Smart (1968), which asserted that biology is not a science because there are no laws for any particular species."); Sections 2[e](2)(b), 2[e](3)(b), and 2[e](4)(b).

839. Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology & Human Values 16, 19 (1982).

creation-science and evolution. Subsection (1) demonstrates that they are to the same extent not fully guided by and explainable by natural laws. Subsection (2) summarizes how they are equally testable, and lists nearly 20 testable claims that constitute creation-science. Subsection (3) discusses how they are equally falsifiable, and lists nearly 20 specific methods of falsifying the aspects of creation-science. Finally, Subsection (4) indicates how creation-science is at least as tentative as evolution. The State's philosophy expert witnesses will support these points at trial. These are material factual issues.

Some creationist scientists have expressed their individual opinions that "neither creation nor evolution is a scientific theory." These statements have been frequently misquoted as concessions that

creation-science is not scientific. However, nothing of the kind is conceded. Instead, the opinions (which are not shared by most creationist scientists) mean either that neither creation-science nor evolution is a scientific "theory" (although each is a scientific hypothesis or scientific model or scientific research programme),840/ or that "biblical creation" (not creation-science) is not a scientific theory.

When rival scientific explanations ex-

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840. Similarly, an evolutionist scientist explains his parallel statement about evolution:

> I made no such claim. I sought to distinguish between theories and other scientific statements, not between science and nonscience. And I made myself very clear about my view of the relationship of explanatory theories to biological classifications. I said (1977:190), "In denying that classifications are scientific theories I do not mean to deny that classifications can be scientific.

Kitts*, Theories and Other Scientific Statements: A Reply to Settle, 29 Systematic Zoology 190, 191 (1980).

ist, the newer research program "should be sheltered for a while from [its] powerful established rival," as Lakatos* notes:

> All this suggests that we must not discard a budding research programme simply because it has so far failed to overtake a powerful rival. We should not abandon it if, supposing its rival were not there, it would constitute a progressive problemshift. And we should certainly regard a newly interpreted fact as a new fact, ignoring the insolent priority claims of amateur fact collectors. As long as a budding research programme can be rationally reconstructed as a progressive problemshift, it should be sheltered for a while from a powerful established rival.
>
> . . . .
>
> One must never allow a research programme to become a Weltanshauung, or a sort of scientific rigour, setting itself up as an arbiter between explanation and non-explanation, as mathematical rigour sets itself up as an arbiter between proof and non-proof.841/

Evolution should not be allowed to become the test between scientific truth and scientific error or nonscience.

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841. 1 I. Lakatos*, The Methodology of Scientific Research Programmes 68, 70-71 (J. Worrall & G. Currie eds. 1978).

(1) Equal Explanation by Natural Laws by Creation-Science and Evolution-Science

Creation-science and evolution-science are to the same extent not "guided by natural law" and explanatory by reference to natural law" in critical aspects, as the first criterion of the McLean definition of science requires.841a/ This requirement, which has been shown to be erroneous above,841b/ is discussed (a) as it applies to evolution and (b) as it applies to creation-science.

(a) Natural Laws and Evolution. Evolution is not fully guided by natural laws and not fully explanatory by reference to natural laws in central areas.

(i) Guidance by Natural Laws. Evolution is not guided by natural laws, in

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841a. McLean v. Arkansas Board of Education, 529 F.Supp. 1255, 1267 (E.D. Ark. 1982).

841b. Section 2 [d](3)(a) supra.

critical areas, because it has the following aspects that are breaks in natural laws:

(i)	Cosmic evolution:	(1) Origin of matter and energy (2) Big bang hypothesis singularity (3) Radiohalo formation
(ii)	Biochemical evolution:	(1) Abiogenesis (origin of life) (2) Extreme improbability and information content
(iii)	Biological evolution:	(1) Occurrence of macro-evolution (origin of organisms) (2) Extreme improbability and information content (3) Irreducibility of life and consciousness

First, cosmic evolution breaches natural laws in significant ways. It includes (1) "the primary origin of matter or energy," for which "science cannot account," which was a singularity842/ that contradicts the natural law of conservation of matter and

energy (the first law of thermodynamics). It also involves (2) a "big bang singularity when . . . we expect general relativity to break down,"843/ which conflicts with known natural laws and involved a break in

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842. W. Stansfield*, The Science of Evolution 53 (1977). Accord, J. Silk*, The Big Bang 144 (1979) ("the singularity, when creation of matter possibly occurred."); Shapley*, The View from a Distant Star, in Adventures in Earth History _____, _____ (_____ ed. 1963) ("Whence came these atoms of hydrogen. . .?"); A. Krauskopf* & A. Beiser*, The Physical Universe 645 (3d ed. 19__) ("Where did the matter come from in the first place?"); _____*, The Universe and Dr. Einstein 104 (1984) ("[T]he problem of initial origin remains. It merely pushes the time of creation into the infinite past."); Section 2 [d](2)(c)(i) supra.

843. R. Wald*, Space, Time, & Gravity: The Theory of the Big Bang 51 (1971). Accord, Weisskopf*, The Origin of the Universe, 71 Am. Scientist 473, 475 (1983) ("the event of infinite density, that so-called singularity, must have occurred less than 20 billion years ago") J. Silk*, The Big Bang 322-24 (1979)("The pioneers of the Big Bang theory were not greatly concerned about the singularity in space--time that was apparently required by the Friedmann equation. The open models possess a singularity at the finite past, and the closed model has both a past and a future singularity (Figure 18.2).").

natural laws.844/ It also faces (3) the formation of radiohalos, which are not now forming by natural processes and could not have formed in the past by natural processes except in an abruptly appearing (created) earth, as discussed above.845/

Second, biochemical evolution also partly conflicts with natural laws. It is centered around (1) abiogenesis (the generation of life from nonlife),,846/ which contradicts

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844. Barrow* & Silk*, The Structure of the Early Universe, Scientific Am., Apr. 1980, at 118, 118, ("What happened at the precise moment of creation is not yet known because unfamiliar physical principles unique to the immense densities and temperatures of that moment mask the initial structure of the universe."); R. Jastrow*, God and the Astronomers 113-114 (1978) "the world had a beginning under conditions in which the known laws of physics are not valid, and as a product of forces or circumstances we cannot discover."); Weisskopf, The Origin of the Universe, 71 Am. Scientist 473, 478 (1983) ("do not know at all what the laws of nature were.").

845. See Kazmann*, It's About Time: 4.5 Billion Years, Geotimes, Sept. 1978, at _____; Section 2[d](1)(b) supra.

the natural law of biogenesis (that life comes only from prior life) as well as the natural law of the chemical tendency away from life (discussed earlier).847/ Astronomer Hoyle concludes that:

> the combinatorial arrangement of not even one among the many thousands of biopolymers on which life depends could have been arrived at by natural processes here on the Earth.848/

Biochemical evolution also includes (2) an extreme improbability, which is calculated to be in the range of 1 chance in 102,000,000 (as discussed above),849/ con-

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846. See Wald*, The Origin of Life, in Physics and Chemistry of Life 3 (1956) ("spontaneous generation"); Section 2[c](2) supra.

847. See Abelson*, Chemical Events on the Primitive Earth, 55 Proc. National Academy of Sciences 1365, 1369 (1966); Section 2[c] (1)(d) supra.

848. Hoyle, The Big Bang in Astronomy, 92 New Scientist 521, 526 (1981).

849, E. Ambrose*, The Nature and Origin of the Biological World 135 (1982). Accord, Sections 2[b](1)(b) and 2[b[(2)(e) supra.

trary to the natural laws or mathematical laws of statistical probability.850/ Wald*, a Nobel Prize recipient, calls this "impossible" except for a scientific "miracle."851/ This is related to the information content of the component proteins and DNA of a first life, which could not come into existence under natural laws.852/

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850. Lafont*, quoting G. Salet*, Chance and Certainty: Evolution in the Light of Modern Biology __ (1972). Accord, E. Borel*, Probabilities and Life 28 (1962); E. Borel*, Elements of the Theory of Probability 57 (1965). Popper* consequently states:

> I do not think that Darwinism can explain the origin of life. I think it quite possible that life is so extremely improbable that nothing can "explain" why it originated; for statistical explanation must operate, in the last instance, with very high probabilities.

Popper*, Intellectual Autobiography, in 2 The Philosophy of Karl Popper, 3, 134-35 (P. Schilpp ed. 1974).

851. Wald*, The Origin of Life, in Physics and Chemistry of Life 3, 9, 12 (1955). Accord, Section 2[b](1)(b) supra.

852. Yockey*, Self Organization Origin of Life Scenarios and Information Theory, 91 Journal of Theoretical Biology 13,

Third, biological evolution in part similarly violates natural laws. It is centered in (1) macroevolution, yet no plausible mechanism exists for macroevolution and the fossil record generally contradicts it (as discussed earlier).853/ Biological evolution also involves (2) an extreme improbability, which has been calculated to be so small that "an adequate scientific theory of [macro]evolution must await the discovery of new natural laws," in the view of Eden* of MIT, leaving biological macroevolution contrary to natural laws or mathemat-

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13 (1981) ("The information content of amino acid secuences cannot increase until a genetic code with an adaptor function has appeared. Nothing which even vaguely resembles a code exists in the physico-chemical world. One must conclude that no valid scientific explanation of the origin of life exists at present."). Accord, Section 2[b](1)(a) supra.

853. P. Grassé*, The Evolution of Living Organisms (trans. 1977); G. Kerkut*, Implications of Evolution (1960); Section 2[a](2)(b) supra.

ical laws of statistical probability.854/ Related to this is an "information content of the higher forms of life . . . represented by the number $10^{40,000}$," the chance of which is comparable to the chance that "a tornado sweeping through a junkyard might assemble a Boeing 747."855/ Finally, biological evolution confronts the problems of life and consciousness, which "biology cannot explain . . . by the current workings

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854. Eden*, Inadequacies of Neo-Darwinian Evolution as a Scientific Theory, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution 109, 110 (P. Moorhead & M. Kaplan eds. 1967). Accord, T. Roszak*, Unfinished Animal 101-02 (1975) ("The irony is devastating. The main purpose of Darwinism was to drive every last trace of an incredible God from biology. But the theory replaces the old God with an even more incredible deity--omnipotent chance."); note 850 supra.

855. Hoyle on Evolution, Nature, Nov. 12, 1981, at 105, 105. Accord, F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 16-17 (1983); Section 2[a](1)(c) supra.

of physical and chemical laws."856/ Thus, each major stage of evolution is not "guided by natural law" in central areas, although it is partially guided by natural laws.

(ii) Explanation by Natural Laws. Evolution is also not "explanatory by reference to natural laws" in important areas, because of the previously discussed breaks

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856. Polanyi*, Life Transcending Physics and Chemistry, Chemical and Engineering News, Aug. 21, 1967, at 54, 55, 64-65 ("The description of a living system therefore transcends the chemical and physical laws which govern its atomic constituents. . . . But the problem of evolution lies beyond my subject here. When I say that life transcends physics and chemistry, I mean that biology cannot explain life in our age by the current workings of physical and chemical laws."). Accord, Polanyi*, Life's Irreducible Structure, 160 Science 1308, 1310 (1968) ("But again, once it is recognized, on other grounds, that life transcends physics and chemistry, there is no reason for suspending recognition of the obvious fact that consciousness is a principle that fundamentally transcends not only physics and chemistry but also the mechanistic principles of living beings.").

in natural laws and because of many elements that are not "explanatory." First, the failure of biological macroevolution in general to provide sufficient explanation is indicted by Grassé* ("the most distinguished of French zoologists"857/) as well as by Popper* (the famous philosopher of science) and many others:

> Their success among certain biologists, philosophers, and sociologists notwithstanding, the explanatory doctrines of biological evolution do not stand up to an objective, in-depth criticism. They prove to be either in conflict with reality or else incapable of solving the major problems involved.858/

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857. Dobzhansky*, Book Review, 29 Evolution 376, 376 (1975).

858. P. Grassé*, Evolution of Living Organisms 202 (1977). Accord, Popper*, Intellectual Autobiography, in 2 The Philosophy of Karl Popper 3, 138 (P. Schilpp ed. 1974) ("While we can explain a particular eclipse by predicting it, we cannot predict or explain any particular evolutionary change (except perhaps certain changes in the gene population within one species); all we can say is that if it is not a small change, there must have been some intermediate steps--an important suggestion for re-

Macroevolution in general has been called

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search: a research progamme."); Lipson*, A Physicist Looks at Evolution, 31 Physics Bulletin, ___, ___ (1980) ("I have always been slightly suspicious of the theory of evolution because of its ability to account for any property of living beings (the long neck of the giraffe, for example). I have therefore tried to see whether biological discoveries over the last thirty years or so fit in with Darwin's theory. I do not think that they do. . . . To my mind, the theory does not stand up at all."); Mayr*, Discussion, in Mathematical Challenges to the NeoDarwinian Interpretation of Evolution _____, 47 (P. Moorhead & M. Kaplan eds. 1967)("Popper is right; this model is so good that it can explain everything, as Popper has rightly complained."); Scriven*, Explanation and Prediction in Evolutionary Theory, 130 Science 477, 481 (1959) ("It is not surprising, therefore, that when we turn to the attempts of Darwin and the Mendelians to formulate some laws of the traditional kind, or to make predictions, we find the results to be very unsatisfactory. As Waddington says, even the modern attempt to develop a mathematical approach to evolution has not 'led to any noteworthy quantitative statements about evolution. . . . The formulae involve parameters . . . most of which are still too inaccurately known to enable quantitative predictions to be made or verified' (13). And if this is the case for the mathematical theory, the case is much worse for exact statements which do not involve the flexibility of mathematical relationships. . . . Tendency statements

merely a tautology, which Popper* defines as having zero explanatory power,859/ by Eden* of MIT and others:

> In consequence the theory has been modified to the point that virtually every formulation of the principles of evolution is a tautology.860/

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like this are explanation-indicators; they justify no more than very weak hypothetical predictions with unspecified conditions ('if everything else was the same, then . . .'), for they tell us nothing about the likelihood of conditions of struggle or the strength of the tendency."); N. Macbeth*, Darwin Retried 147 (1971) ("Unfortunately, in the field of evolution most explanations are not good. As a matter of fact, they hardly qualify as explanations at all; they are suggestions, hunches, pipe dreams, hardly worthy of being called hypotheses.").

859. Popper*, Natural Selection and the Emergence of Mind, 32 Dialectica 339 (1978).

860. Eden*, Inadequacies of Neo-Darwinian Evolution as a Scientific Theory, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution 109 (P. Moorhead & M. Kaplan eds. 1967). Accord, Manser*, The Concept of Evolution, 40 Philosophy 18, 26-27 (1965) ("As in the case of 'adaptation', other key terms of the theory, such as 'variation' and 'environment,' suffer from circular definitions. . . . Hence I think that much of what is said by those who defend the theory of evolution in

Second, the various integral parts of macroevolution similarly have been criticized widely as nonexplanatory and tautologous. Adaptation has been severely scrutinized as nonexplanatory861/ and as tautologous:

> As an instance, the statement that species adapt to changes in an environ-

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its present form is only a redescription of the phenomena, though this does not mean that such a redescription was not worth carrying out. Because the normal scientific way of doing this is to give a causal explanation, the presumption is that such an account is also given by the theory of evolution. But what has rather been done is to produce a terminology in which the phenomena can be set, and at the same time an illusion of explanation.").

861. Manser*, The Concept of Evolution, 40 Philosophy 18, 26-27 (1965); N. Macbeth*, Darwin Retried 77 (1971) ("When the most learned evolutionists can give neither the how nor the why, the marvels seem to show that adaptation is inexplicable. Yet those who cannot explain it will not admit that it is inexplicable. This is a strange situation, only partly ascribable to the rather unscientific conviction that evidence will be found in the future. It is due to a psychological quirk . . .."); id. at 104 ("We agree that Darwinism cannot predict, but we must remind Professor Mayr that it also cannot explain . . ..").

> ment by a variation in the properties of phenotypes and by the consequent process of natural selection is clearly vacuous. . . . Since these are the only possibilities, the original statement is tautologous.862/

Population genetics (one of the macroevolu-

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862. Eden*, Inadequacies of Neo-Darwinian Evolution as a Scientific Theory, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution 109, _____ (P. Moorhead & M. Kaplan eds. 1967). Accord, Popper*, Intellectual Autobiography, in 2 The Phillosophy of Karl Popper 3, 137 (P. Schilpp ed. 1974) ("Take 'adaptation.' At first sight natural selection appears to explain it, and in a way it does, but it is hardly a scientific way. To say that a species not living is adapted to its environment is, in fact, almost tautological."); Saunders* & Ho*, Is Neo-Darwinism Falsifiable?--And Does It Matter?, 4 Nature and System 179 (1982)("The neoDarwinist claim to sufficiency is of great importance in evolutionary biology for it completely delimits the type of explanation that is either desired or even acceptable, and therefore the sort of research that is to be carried out. Forty years ago, Huxley (1942, p. 23) criticized research devoted to "the paper demonstration that such and such a character was or might be adaptive," but the synthetic theory of which he was one of the founders is now serving as the justification for precisely this kind of work."); Grene*, ___ _____, in Toward a Theoretical Biology ___, 61 (C. Addington _____ ed. 1969).

tionary mechanisms) "explains nothing" according to Lewontin* of Harvard,863/ while classifications (one of the macroevolutionary arguments) "are not meant to explain" in the view of Kitts*,864/ and migration (another mechanism) and other ecological claims "are actually tautologies" and "are

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863. R. Lewontin*, The Genetic Basis of Evolutionary Change 11-12 (1974) ("If one simply cannot measure the stated variables or the parameters with which the theory is constructed, or if their measure is so laden with error that no discrimination between alternative hypotheses is possible, the theory becomes a vacuous exercise in formal logic that has no point of contact with the contingent world. The theory explains nothing because it explains everything. It is my contention that a good deal of the structure of evolutionary genetics comes perilously close to being of this sort."). Accord, J. Roughgarden*, Theory of Population Genetics and Evolutionary Ecology ____ (1979).

864. Kitts*, Karl Popper, Verifiability, and Systematic Zoology, 26 Systematic Zoology 185, 189 (1977) ("Classifications are not meant to explain. They are meant to be explained. The joint attributes of taxa and the gaps separating taxa are not explained by a classification. They are stated by means of a classification.").

not scientific theories at all" in the words of Peters.*865/

Third, natural selection has received the most widespread and vehement criticism (by evolutionists) as unexplanatory and tautologous (as well as nonfalsifiable, as discussed below866/). This is no small matter, because natural selection "remains the fundamental process directing evolutionary change."866a/ It is called nonexplana-

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865. Peters*, Tautology in Evolution and Ecology, 110 American Naturalist 1, 1, (1976) ("I argue that the 'theory of evolution' does not make predictions, so far as ecology is concerned, but is instead a logical formula which can be used only to classify empiricisms and to show the relationships which such a classification implies. Similar criticisms are then made of several ecological concepts. The essence of the argument is that these 'theories' are actually tautologies and, as such, cannot make empirically testable predictions. They are not scientific theories at all.").

866. Section 2[e](3)(b) infra.

866a. T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 32, 504 (1977). Accord, Mayr*, Prologue, in The Evolutionary Synthesis 1, 24 (E. Mayr &

tory by Rosen* (of the American Museum of Natural History) and others:

> Although natural selection theory fails to explain the origin of evolutionary novelties, its greatest shortcoming in terms of evolutionary theory is that it fails to explain evolutionary diversity.867/

W. Provine eds. 1980) ("second of the two principal components of Darwin's theory of evolution"). Punctuated equilibria proponents question the centrality of natural selection but generally leave it an important role.

867. Rosen*, Book Review, 27 Systematic Zoology 370, 372 (1978). Accord, S. Toulmin*, Science, Philosophy of, 16 Encyclopaedia Britannica 375, 389 (15th ed. 1974) ("[O]ne distinguished Empiricist philosopher, Carl Hempel, has drawn a somewhat extreme conclusion, viz., that the theory of natural selection is not really an explanation of organic evolution at all--not even a bad one--but is merely an elaborate redescription of the historical episodes concerned."); N. Macbeth*, Darwin Retried 44 (1971) ("Natural selection is almost always handled in general terms. . . . This means that it has no explanatory power when specific problems arise. . . . [Deevey] says: 'Of course these things are marvels, and of course, the fossil record being what it is, no one can say with confidence exactly how any one of them came about.' Note the word exactly. The Darwinians contend that any given result must have been produced by natural selection working on small changes, but when asked to be exact they are helpless.").

It is termed tautologous for similar reasons by Waddington* of Oxford:

> Darwin's major contribution was, of course, the suggestion that evolution can be explained by the natural selection of random variations. Natural selection, which was at first considered as though it were a hypothesis that was in need of experimental or observational confirmation, turns out on closer inspection to be a tautology, a statement of an inevitable although previously unrecognized relation. It states that the fittest individuals in a population (defined as those which leave most offspring) will leave most offspring.868/

The tautology criticism of natural selection or its "survival of the fittest" also has been made in published articles by dozens of scientists and philosophers of science such as the following:

Stanley* of John Hopkins,869/
Rosen* of the American Museum,870/
Patterson* of the British Museum,871/
Haldane*,879/
Barker*,880/
Delbruck*,881/
Koestler*,882/
Smart*,883/
Flew*,884/

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868. Waddington*, Evolutionary Adaptation, in 1 Evolution after Darwin 381, 385 (S. Tax ed. 1960).

Eden* of MIT,872/
Hoyle,873/
Grene*,874/
Cannon*,885/
Macbeth*,886/
Bethell*,887/

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869. S. Stanley*, Macroevolution 192 (1979) ("I tend to agree with those who have viewed natural selection as a tautology rather than a true theory (see review by Peters, 1976). It is essentially a description of what has happened . . .").

870. Rosen* responds to Gould's* counterargument:

> The real problem with Darwinian selection theory, however, is that it can explain everything, and therefore, nothing. By logical necessity what survives (or what produces more offspring) is more fit than what doesn't, what is more it is therefore better adapted, and what is better adapted is therefore selected for (or in other words, survives). When Gould (1976) recently responded to continuing criticism of selection theory by using goodness of human engineering design as an independent criterion of animal and plant fitness, he was, in effect, rejecting not only Waddington's logic, but neo-Darwinism as well: ". . . let me admit that Bethell's criticism applies to much of the technical literature in evolutionary theory, especially to the abstract mathematical treatments . . . [i.e., population genetics]. These studies do assess fitness only in terms of differential survival . . . Nature, however, is not limited by the calculations of theoretical geneticists." Gould is unable to tell

Brady*,875/
Peters*,876/
Himmelfarb*,877/
Harris*,878/
Rifkin*,888/
Roszak*,889/
Lerner*,890/ and
Saunders* & Ho*,891/

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us how to recognize a successful organism apart from its existence, or what exactly is the reason for its existence as compared with others which have died off, or which attribute of the organism shall be compared with human engineering achievements, or even how such comparisons can be rendered objective. In short, he has provided no reason not to reject the tautology other than what he believes is its popularity: "I maintain, perhaps naively, that [selection's] current unabated popularity must have something to do with its success in explaining the admittedly imperfect information we now possess about evolution." Of course selection is successful in explaining nature, since the characteristic of tautologies is that they explain everything. And, of course, that is the true measure of selection's appeal. But is Gould asking us to believe that the true measure of a scientitic theory is decided in a popularity contest regardless of its internal logical structure? Gould does, indeed, "maintain naively."

Rosen*, Book Review, 27 Systematic Zoology 370, 370-71 (1978).

871. C. Patterson*, Evolution 146-47 (1978).

872. Eden*, Inadequacies of Neo-Darwinian Evolution as a Scientific Theory, in

Thus, evolution is not "explanatory by re-

Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution 5 ____ (P. Moorhead & M. Kaplan eds. 1967), ("Concepts such as natural selection by the survival of the fittest are tautologous; that is, they simply restate the fact that only the properties of organisms which survive to produce offspring, or to produce more offpring than their cohorts, will appear in succeeding generations.").

873. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 32, 244 (1983) ("the idea of natural selection is little more than a trivial tautology").

874. Grene*, _____, in Toward Biology, _____ 61 (C. Waddington ed. 1969) ("It must then, and is usually said to, be 'survival that adaptation is 'for.' But in that case the whole theory' becomes a tautology, a complicated way of saying simply that what survives survives."); M. Grene*, The Knower and the Known 193-95 (1974).

875. Brady*, Natural Selection and the Criteria by Which a Theory Is Judged, 28 Systematic Zoology 600, 607 (1979) ("some versions of the theory--i.e., differential reproduction--are tautological"). Brady* argues that the real problem is the unfalsifiability rather than tautology of macroevolution.

876. Peters*, Tautology in Evolution and Ecology, 1 American Naturalist 110 ____ (1976)("Instead they consist of the logical elaboration of certain axioms. Consequently, they must be termed tautologies.").

ference to natural laws" in critical aspects.

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877. G. Himmelfarb*, Darwin and the Darwinian Revolution 316 (1959) ("The survivors, having survived, are thence judged to be the fittest.").

878. C. Harris*, Evolution, Genesis and Revelations 189-90 (1981) ("This is a circular argument--a tautology. 'Survival of the fittest' may thus be taken as an untestable truism--an axiom.").

879. J. Haldane*, _____ (1935).

880. Barker*, An Approach to the Theory of Natural Selection, Philosophy, Oct. 1969, at ___

881. Delbruck*, _____ (1949).

882. A. Koestler*, Janus: A Summing Up (1978).

883. J. Smart*, Philosophy and Scientific Realism (1963).

884. Flew*, A Comment on Manser, Philosophy, Jan. 1966, at _____, _____.

885. Cannon*, _____, (1959).

886. N. Macbeth*, Darwin Retried 62-63 (1971) ("[S]omeone asked how we determine who are the fittest. The answer came back that we determine this by the test of survival; there is no other criterion. But this means that a species survives because it is the fittest and is the fittest because it survives, which is circular reasoning and equivalent to saying that whatever is, is fit. The gist is that some survive and some die, but we knew this at the outset. Nothing has been explained."); id. at 47 ("If we say that evolution is accomplished

Summary. Evolution is neither "guided

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largely by natural selection and that natural selection consists of differential reproduction, what have we done? Differential reproduction means that some species multiply by leaving more offspring than one-for-one, while others leave one-for-one and remain stable, and others leave less than one-for-one and dwindle or die out. Thus we have as Question: Why do some multiply, while others remain stable, dwindle, or die out? To which is offered as Answer: Because some multiply, while others remain stable, dwindle, or die out. The two sides of the eduation are the same. We have a tautology. The definition is meaningless.").

887. Bethell, Darwin's Unfalsifiable Theory, Kronos, Summer 1982, at 33, 33-34 ("Darwin proposed no criterion of fitness other than that of survival itself. [I]t follows that 'the survival of the fittest' is not a testable theory, but a tautology. Which one survives? The fittest. Who are they? Those that survive."); Bethell, Darwin's Mistake, Harper's Magazine, Feb. 1976, at 70, 72 ("tautology").

888. J. Rifkin*, Algeny 143 (1983) ("tautology").

889. T. Roszak*, Unfinished Animal 101 (1975)("at key points, Darwin's theory bottled down to empty tautologies and unproven assumptions.").

890. I. Lerner*, The Genetic Basis of Selection 10 (1958).

891. Saunders* & Ho*, Is Neo-Darwinism Falsifiable?---And Does It Matter?, 4 Nature & System 179, 183 (1982)("the principle of natural selection is tautological").

by natural law" nor "explanatory by natural law" (which the McLean opinion listed as an "essential characteristic of science") in central parts. Creation-science meets this natural law requirement (if this criterion is not rejected) to the same extent as evolution does.

(b) Natural Laws and Creation-Science. Creation-science is guided by natural laws and explanatory by reference to natural laws to the same extent that evolution is.

(i) Guidance by Natural Laws. Creation-science is similarly guided by natural laws to the same partial extent as evolution is. First, its affirmative evidences all involve scientific data and scientific interpretations, as the above discussion of creation-science shows.893/ Second, crea-

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893. Sections 2[a](1), 2[b](1) and 2[c](1) supra.

tion-science accepts and incorporates the current formulation of virtually all natural laws. Cosmic creation accepts the laws of thermodynamics, gravity, electromagnetism, weak and strong nuclear forces, light, and matter and energy, etc., and agrees that these laws have governed subsequent development and change of the universe. Biochemical creation accepts the laws of chemistry, probability, genetics, etc., and similarly agrees that these laws have guided subsequent change and development. Biological creation similarly accepts the laws of genetics, variation, isolation, cell structure, organ structure, energy transport, etc., and concurs that these laws have guided subsequent change and development of organisms, including the development of genetic variation.

Third, because scientific evidence does indeed point to abrupt appearances of

the universe, first life, and genera/families of organisms, this is properly summed up in a natural law of the abrupt appearances in complex form of a universe, a first life, and genera/families of organisms at least once in the past.894/ While this involves a natural law different from those operating today, the same is true of cosmic evolution (origin of matter and energy contrary to the second law of thermodynamics and big bang with or preceded by different natural laws), of biochemical evolution (origin of life contrary to the law of biogenesis and contrary to the laws of statistical probability), and of biological macroevolution (origin by macroevolution of or-

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894. Similarly, the inflationary universe hypothesis of Guth* and Steinhardt* proposes that an appearance of the universe "from absolutely nothing" is "describable by physical laws." Guth* & Steinhardt*, The Inflationary Universe, Scientific American, May 1984, at 116, 128.

ganisms contrary to the capacity of natural selection and other mechanisms and contrary to the laws of statistical probability).895/ Although this natural law of abrupt appearance involves one or several singularities, the same is true of cosmic evolution (the origin of matter and energy and the big bang), of biochemical evolution (abiogenesis of the first life), and of biological macroevolution (an irreversible process).896/ A counterargument that such an abrupt appearance could not have happened is based on an unsupported faith that present natural laws have always operated (except when evolution requires otherwise) and that no additional natural laws have ever operated (except when evolution requires otherwise). Instead, creation-science is "guided by natural laws"

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895. Section 2[e](1)(a)(i) supra.
896. Id.

to the same extent that evolution is.

(ii) Explanation by Natural Laws. Creation-science is also "explanatory by reference to natural laws" to the same partial extent as evolution is. First, its affirmative evidences involve scientific data and scientific explanations, as described above897/ and as summarized by Kenyon (a creationist scientist):

> On the contrary, the creationist view of the origin of life is based on a detailed analysis of laboratory information from molecular biology, biochemistry, organic chemistry, the simulation experiments on chemical evolution, as well as relevant aspects of physics, geology, astrophysics, probability and information theory.898/

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897. Sections 2[a](1), 2[b](1), and 2[c](1) supra.

898. Kenyon, The Creationist View of Biological Origins, NEXA Journal, Spring 1984, at 28, 31. Kenyon earned his Ph.D. degree at Stanford in biophysics, published a major scientific book based on research in biochemical evolution, and is a professor of biology at San Francisco State University.

Second, creation-science is scientific in "establish[ing] the existence of a phenomenon" (creation) even if it does not "explain that phenomenon in a lawlike way." Laudan* makes this distinction and criticizes the McLean opinion for missing the distinction and imposing an incorrect "explanatory by natural law" requirement:

> For centuries scientists have recognized a difference between establishing the existence of a phenomenon and explaining that phenonemon in a lawlike way. Our ultimate goal, no doubt, is to do both. But to suggest, as the McLean Opinion does repeatedly, that an existence claim . . . is unscientific until we have found the laws on which the alleged phenomenon depends is simply outrageous. Galileo and Newton took themselves to have established the existence of gravitational phenomena, long before anyone was able to give causal or explanatory account of gravitation. Darwin took himself to have established the existence of natural selection almost a half-century before geneticists were able to lay out the laws of heredity on which natural selection depended. If we took the McLean Opinion criterion seriously, we should have to say that Newton and Darwin were unscientific; and, to take an example from our own time, it

> would follow that plate tectonics is unscientific because we have not yet identified the laws of physics and chemistry which account for the dynamics of crustal motion.899/

Brady* notes the same nonnecessity of a mechanism and the possible advantage of lack of a mechanism:

> The actual discovery of the patterns of nature may not necessitate a theory of their mechanism. The discovery of the natural system in taxonomy did not depend upon a speculation on the mechanism by which the system came about, but Darwin's speculation on mechanism drew heavily on what was already known of that system . . .. But this represents an advantage, for we are not so likely to generate a pattern from our theoretical mechanism, rather than from our observations, if we have no theoretical mechanism.900/

In fact, the absence of a mechanism for explanation by natural laws is as true of evolution as it has been alleged to be

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899. Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 18 (1982).

900. Brady*, Natural Selection and the Criteria by Which a Theory Is Judged, 28 Systematic Zoology 600, 620 (1979).

for creation-science. In biological macro-evolution, the mechanism is subject to great debate (and is currently insufficient), as Patterson* observes:

> Now as you all know there is somewhat of a revolution going on in evolutionary theory at the moment. . . . It concerns the possible mechanisms that are responsible for transformations. . . . Well, here is Gillespie again on creationism in the 1850s. He says:
>
> > 'Frequently, those holding creationist ideas could plead ignorance of the means and affirm only the facts.'
>
> That seems to summarize the feeling I get in talking to evolutionists today. They plead <u>ignorance of the means</u> of transformation but affirm only the facts, knowing that it has taken place. Again the two points do seem hard to distinguish.<u>901</u>/

In biochemical evolution, the proposed mechanism again falls vastly short (particularly in view of improbability and information

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901. Address of Dr. Colin Patterson*, American Museum of Natural History, tr. at 3-4 (Nov. 5, 1981).

content problems).901a/ In cosmic evolution, the mechanism of the big bang cannot even be studied (other than by conjecture), as Jastrow* acknowledges:

> [F]or the astronomical evidence proves that the Universe was created twenty billion years ago in a fiery explosion, and in the searing heat of that first moment, all the evidence needed for a scientific study of the cause of the great explosion was melted down and destroyed.902/

Third, it would be highly unscientific "to exclude data which lead to the conclusion that the universe, life and man" were created, just because creation-science allegedly cannot "explain that phenomenon in a lawlike way," as von Braun (the late Director of the NASA space program) argued:

> [T]he scientific method does not allow us to exclude data which lead to the conclusion that the universe, life and

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901a. Section 2[e](1)(a)(ii) supra.

902. R. Jastrow*, God and the Astronomers 12 (1978). Accord, Section 2[e](1)(a)(i) supra.

> man are based on design. To be forced to believe only one conclusion--that everything in the universe happened by chance--would violate the very objectivity of science itself. . . .
>
> . . ..
>
> The inconceivability of some ultimate issue (which will always lie outside scientific resolution) should not be allowed to rule out any theory that explains the interrelationship of observed data and is useful for prediction.903/

Further, creation-science indeed does "explain [the] phenomenon [of creation] in a lawlike way," as discussed above.904/

Summary. Thus, creation-science is in significant ways "guided by natural laws" and "explanatory by reference to natural laws." The scientific data point to a natural law of abrupt appearance in complex form that has occasionally been manifested by cosmic creation, biochemical creation,

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903. Letter from Dr. Wernher von Braun to Dr. Vernon Grose (Sept. 14, 1972). Accord, Section 2[e](1)(a)(i) supra.

904. Section 2[a](1)(b) supra.

904a. Section 2[d](3)(b) supra.

and biological creation. This is a material factual issue.

Conclusion. Thus, creation-science and evolution are to the same extent not fully guided by natural laws, and to the same extent do not fully explain phenomena by natural laws. This is a material factual issue.

(2) Equal Testability of Creation-Science and Evolution Overview. The McLean requirement of testability, which has been criticized above,904a/ is also equally met by creation-science and evolution. Laudan* acknowledges the falsity of this charge (while strongly opposing creation-science):

> At various key points in the Opinion, Creationism is charged with being untestable, dogmatic (and thus nontentative), and unfalsifiable. All three charges are of dubious merit. For instance, to make the inter-linked claims that Creationism is neither falsifiable nor testable is to assert that Creationism makes no empirical assertions whatever. That is surely false. Creationists make a wide range of testable assertions about empirical matters of fact. Thus, as Judge Overton himself grants they assert the limited variability of species. . . .
>
> In brief, these claims are testable, they have been tested, and they have failed those tests. Unfortunately, the logic of the Opinion's analysis precludes saying any of the above. . . . The correct way to combat Creationism is to confute the empirical claims it does make, not to pretend that it makes no such claims at all.905/

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905. Laudan*, Commentary: Science at

(a) Testability of Creation-Science. Creation-science indeed is testable--and in fact all of the affirmative evidences described above are explicitly testable.

Several leading evolutionists, besides Laudan*, have acknowledged the testability of at least significant parts of creation-science (while believing that it has failed the tests), including Gould* (an ACLU witness), Raup*, and the National Academy of Sciences*:

> Creationists do offer some testable statements, and these are amenable to scientific analysis. Why, then, do I continue to claim that creationism isn't science? Simply because these relatively few statements have been tested and conclusively refuted.906/

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the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 16-17 (1982). See also Laudan*, The Demise of the Demarcation Problem, in 2 Working Papers in Science and Technology at 7, 25 (R. Laudan ed. 1983). We do not agree with the definition of creation-science used by Laudan* in his former article.

906. Gould*, _____,

> In my view, a few of the arguments used by the creationists are "scientific" in the sense that they use the basic methods of testing hypotheses normally considered to be scientific. This does not mean, of course, that the conclusions are correct.907/
>
> Moreover, when the evidence for creationism has been subjected to the

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Atlantic, June 4, 1982, at ____, _____. Accord, Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 17 (1982) (We do not agree that the abrupt appearance of organisms is necessarily "supernatural.") Parts of evolution are similarly not testable. Brady*, Dogma and Doubt, 17 Biological Journal of the Linnaean Society 79, 89 (1982) ("These are, in the order of discussion, the transference of empirical support from a testable part of the theory to the untested central thesis, a claim of confirmation that cannot be credited to the theory at all, and a general claim of 'fruitfulness'."); Dobzhansky*, On Methods of Evolutionary Biology and Anthropology, 45 American Scientist ____, 388 (1957)("The applicability of the experimental method to the study of such unique historical processes is severely restricted before all else by the time intervals involved, which far exceed the lifetime of any human experimenter."); Section 2[d](3)(b) supra.

907. D. Raup*, The Geological and Paleontological Age of Creationism, in Scientists Confront Creationism 147, 159 (L. Godfrey ed. 1983).

tests of the scientific method, it has been found invalid.908/

The affirmative evidences for creation-science, in each of its three aspects, are testable:

Aspect of Creation-Science	Affirmative Evidence	Testable Claim
(i) Biological creation: (a) Paleontology argument:	The fossil record is generally characterized by an abrupt appearance of complex genera/families and higher categories, and by systematic gaps between such fossil categories.	
(b) Comparative morphology argument:	The structure of fossilized organisms generally is systematically similar to their mo-	

908. Committee on Science and Creationism*; Science and Creationism: A View from the National Academy of Sciences 26, ____ (1984).

dern-day counterparts, and generally exhibits systematic stasis until the present or their extinction.

(c) Information content argument

The information content of all organisms, including their complex features and molecules, is sufficiently vast to render biological creation more plausible and biological macroevolution extremely implausible.

(d) Probability argument:

The mathematical probability is higher for biological creation and vastly low for biological macroevolution of complex features, complex organs, and symbiotic organisms.

(e) Genetics argument:

Genetic limits on the scope and frequency of viable mutations generally restrict viable variation or microevolution, provide genetic barriers between genera/families, and prevent biological macroevolution.

(f) Comparative unrelatedness argument:

Anomalies in classification, comparative anatomy, and comparative biochemistry are sufficiently extensive as to point more plausibly to distinct ancestry than common ancestry of various genera/families.

(ii)
Biochemical creation:

(a)
Information content argument:

The information content of the least complex organisms and their genetic coding systems is sufficiently vast to render biochemical creation more plausible and biochemical evolution extremely implausible.

(b)
Probability argument:

The mathematical probability is higher for biochemical creation and vastly low for biochemical evolution of the least complex organisms and of their enzymes, other proteins, and DNA.

(c)
Isomers argument:

The isomers in protein amino acids and nucleic acid sugars would not plausibly have arisen in a primordial soup, but are generally necessary to life,

and are more plausibly explained by biochemical creation.

(d) Chemistry argument:
The general chemical tendency outside of a living organism is away from life and away from molecules necessary for life rather than toward life.

(e) Thermodynamics argument:
The thermodynamic probability of the first life is higher for biochemical creation and vastly low for biochemical evolution.

(iii) Cosmic creation:

(a) Thermodynamics argument:
The first and second laws of thermodynamics require a beginning for the universe and preclude its eternal existence.

(b) Radiohalos argument:
The polonium halos in the earth's crust require an abruptly appearing and initially cool earth, in the absence of uranium or thorium halos.

(c)
Information
content
argument:
The information content of the universe is sufficiently vast to render cosmic creation more plausible and cosmic evolution extremely implausible.

(d)
Heterogeneity
argument:
The heterogeneity of the universe is implausible under the big bang hypothesis and more plausibly explained by cosmic creation.

(e)
Star and
galaxy
formation
argument:
The formation of galactic clusters, galaxies, stars and solar system requires extremely improbable conditions or is not explainable by but contrary to natural laws and is more plausibly explained by cosmic creation.

All of these important parts of creation-science are testable at least to the extent that evolution is.

The existence of parts of creation-science and evolution that are not testable does not render either nonscientific. One philosopher of science noted that this is not unique of "creationism": "It is now widely acknowledged that many scientific claims are not testable in isolation, but only when embedded in a larger system of statements, some of whose consequences can be submitted to test."908a/ Creation-science and evolution and their consequences are equally testable.

(b) Limited Testability of Evolution. Evolution is not testable in critical aspects. These include the aspects that conflict with natural laws (as discussed

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908a. Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 17 (1982). Accord, Brady*, Dogma and Doubt, 17 Biological Journal of the Linnaean Society 79, 89 (1982) ("from a testable part of the theory [of evolution] to the untested central thesis").

above908aa/), and also several central parts of biological macroevolution including natural selection and adaptation.

(i) Partial Nontestability of Biological Macroevolution. The nontestability of one or more critical parts of biological macroevolution has been acknowledged by the following scientists and philosophers, who are discussed in this Section (as well as the others who call natural selection tautologous):

Popper*	Ho*	Harris*
Patterson*	Brady*	Forey*
Birch*	Cracraft*	Stanley*
Ehrlich*	Macbeth*	Bertalanffy*
Saunders*	Wassermann*	Bethell

For example, Popper* (the philosopher of science who formulated the testability-falsifiability requirement) states of evolution: "It is metaphysical because it is not test-

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908aa. Section 2[e](1)(a)(i) supra.

able."908b/ The absence of potential tests is described by Saunders* and Ho*:

> In this section we consider in detail a number of tests of the theory that have been proposed, and we shall see how each of them fails. It is not just a question of lack of imagination on the part of neo-Darwinists. By its very nature, theory does not allow itself to be tested.909/

908b. Popper*, Intellectual Autobiography, in 2 The Philosophy of Karl Popper, 3, 136 (P. Schilpp ed. 1974). Accord, C. Patterson*, Evolution 147 (1978)("evolutionary theory is not testable in the same way as a theory in physics, or chemistry, or genetics . . .."); Birch* & Ehrlich*, Evolutionary History and Population Biology, 214 Nature 349, 352 (1967) ("Our theory of evolution has become . . . one which cannot be refuted by any possible observations. It is thus 'outside of empirical science' . . . .").

909. Saunders* & Ho*, Is Neo-Darwinism Falsifiable?-- And Does It Matter?, 4 Nature and System 179, 185 (1982). Accord, Brady*, Natural Selection and the Criteria by Which a Theory is Judged , 28 Systematic Zoology 600, 621 (1979) ("But until the organism can be theoretically reduced to determinate laws, the theory is too incomplete to be testable."); Cracraft*, The Use of Functional and Adaptive Criteria in Phylogenetic Systematics, 21 American Zoologist 21, 34 (1981) ("First, axiomatic reasoning, as it is employed by functional evolutionary

One reason is that macroevolution is "a historical theory, about unique events, and unique events are, by definition, . . . unrepeatable and so not subject to test."910/

The element of macroevolution that has been most criticized as untestable is natural selection, as Popper* exemplifies:

> I intend to argue that the theory of natural selection is not a testable scientific theory, but a metaphysical research programme; and although it is no doubt the best at present available, it can perhaps be slightly improved.911/

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morphology, simply does not increase our knowledge about process. It seduces investigators (particularly students) into thinking they are working on questions of general importance when they are not. Second, this form of axiomatic reasoning leads to an abundance of untestable statements in the literature."); N. Macbeth*, Darwin Retried 99 (1971) ("Let us now apply all this to classical Darwinism. Anyone familiar with the literature knows how everything is taken as a confirmation. Also, there is no way to test large parts of the theory by experiment.").

910. C. Patterson*, Evolution 145-46 (1978). Accord, N. Macbeth*, Darwin Retried 93 (1971).

911. Popper*, Unended Quest 151 (rev. ed. 1976). Accord, Forey*, Neontological

Besides the tautology and nontestability problem of identifying the "fit" organisms for "survival of the fittest,"912/ the dual

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Analysis Versus Palaeontological Stories, in Problems of Phylogenetic Reconstruction 119, 124 (K. Joysey & A. Friday eds. 1982) ("Suffice it to say that there have been recent views (Løvtrup 1977; Macbeth 1973; Rosen 1978) expressing serious doubts about the theory of natural selection, or at least the ways in which it may be tested and placed on a scientific plane. I confess sympathy with these views."); Brady*, Dogma and Doubt, 17 Biological Journal of the Linnaean Society 79, 79 (1982)("I shall argue, in the following discussion, that the real difficulty behind the recent criticisms is the inconclusive empirical status of the theory [of natural selection], and that the belief with which the theory is embraced by the defenders makes that empirical inclusiveness all but invisible to them."); A. Koestler*, Janus: A Summing Up 179 (1978) (quoting L. von Bertalanffy) ("I think the fact that a theory so vague, so insufficiently verifiable and so far from the criteria otherwise applied in 'hard' science, has become a dogma, can only be explained on sociological grounds.").

912. C. Harris*, Evolution, Genesis and Revelations 189-90 (1981) ("'Survival of the fittest' may thus be taken as an untestable truism--an axiom."); Bethell, Darwin's Unfalsifiable Theory, Kronos, Summer 1982, at 33, 33-34 ("'the survival of the fittest' is not a testable theory,

mechanism of natural selection and genetic drift renders each "no longer testable."913/

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but a tautology."); Bethell, Darwin's Mistake, Harper's Magazine, Feb. 1976, at 70, 75; Section 2[e](1)(a) (ii) supra.

913. C. Patterson*, Evolution 70 (1978) ("When these two theories [natural selection and genetic drift] are combined, as a general explanation of evolutionary change, that general theory is no longer testable. Take natural selection: no matter how many cases fail to yield to a natural selection analysis, the theory is not threatened, for it can always be said that these failures of selection theory are explained by genetic drift. And no matter how many supposed examples of genetic drift are shown to be due, after all, to natural selection, the neutral theory is not threatened, for it never pretended to explain all evolution."). Accord, Harris*, An Axiomatic Interpretation of the Neo-Darwinian Theory of Evolution, 18 Perspectives in Biology and Medicine 179, 182 (1975) ("It could be argued that the neo-Darwinian theory can be stated in such a way that it is testable and that experimental proof of the theory in that form would therefore prove the axioms. Fisher's fundamental theorem, which states that 'the rate of increase in fitness of any organism at any time is equal to its genetic variance in fitness at that time' [6, chap. 1] perhaps comes closest to stating a theory of evolution in testable form. But in fact, the theorem is not uniquely neo-Darwinian because it does not specify the means by which mutations arise.

Further, the claim (made by most punctuated equilibria advocates) "that natural selection operated with greatest effect exactly where it was least likely to be documented --in small, localized, transitory populations--would have seemed to render Darwin's new theory nontestable . . .."914/ The related concept of adaptation has similarly been criticized as nontestable:

> The fact that numerous biologists have indulged in untestable ad hoc speculations about the manner in which specific adaptations could have been attained by natural selection does not vindicate their enterprise as being 'scientific'. Popper's attacks on such abuses of the concept of natural selection are fully justified.915/

Hence, it does not afford a test of the first axiom. Fisher also defined fitness in terms of the number of offspring per parent, that is, survival of the lineage. Therefore, the theorem also fails to provide a test of the second axiom.").

914. S. Stanley*, Macroevolution 6 (1979). Accord, Section 2[a](2)(b)(vi) supra.

915. Wassermann*, Testability of the Role of Natural Selection within Theories

Such speculations about adaptation of spe-

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of Population Genetics and Evolution, 29 British Journal of Philosophy of Science 223, 240 (1978). Accord, Popper*, Intellectual Autobiography, in 2 The Philosophy of Karl Popper 3, 137 (P. Schilpp ed. 1974) ("Adaptation or fitness is defined by modern evolutionists as survival value, and can be measured by actual success in survival; there is hardly any possibility of testing a theory as feeble as this."); Brady*, Dogma and Doubt, 17 Biological Journal of the Linnaean Society 79, 88 (1982) ("I have argued within it that until the organism is reduced to a determinate system, we have not the knowledge to mount a good test of optimalization theory--that is, we cannot question it. If that is so, it follows that the theory has no empirical support. Its strength comes from its logical power to generate explanations for every manner of organic adaptation rather than from the evidence, which, as we have seen, contains no potential for falsification. The theory may be true, but whether it is or not, it cannot be said to have shown evidence of this truth, and the widespread acceptance of the theory must rest on some other grounds."); G. Wassermann*, Testability of the Role of Natural Selection within Theories of Population Genetics and Evolution. 29 British Journal of Philosophy of Science 223, 223-24 (1978) ("The second kind of explanation, which relies on natural selection, is found in attempts to 'explain' the genesis and maintenance of specific evolutionary adaptations by resort to existentially quantified ad hoc hypotheses, which

cific organisms are "thoroughly untestable" and "an article of faith rather than a scientific statement."916/ Other nontestable

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sometimes may be linked hypothetically to theories of population genetic mechanisms. As neither, these ad hoc hypotheses nor their specially postulated linkage with theories of general mechanisms are falsifiable, the hypotheses as well as the linkages are not testable. Such 'explanations' of adaptations are therefore metaphysical.").

916. Cracraft*, The Use of Functional and Adaptive Criteria in Phylogenetic Systematics, 21 American Zoologist 21, 31-32 (1981) ("The causal process is outside the realm of analysis for those investigating historically-based events. The critical factor in the scientific study of any phenomenon is that explanatory hypotheses should be susceptible to criticism, that explanations should be evaluated by empirical tests of some sort. As far as I can see, statements of the type that 'phenotype x is an adaptation, evolved via the agency of natural selection' are thoroughly untestable. The necessary data needed to refute such an assertion cannot be gathered, and we are more or less forced to accept it as an article of faith rather than as a scientific statement."). Accord, Brady*, Dogma and Doubt, 17 Biological Journal of the Linnaean Society 79, 88 (1982) ("When we try to understand adaptation we are reduced to 'just so' stories because the possibilities are limited only by imagination. It is this very indeterminacy that caused Le-

elements of macroevolution are phylogenies (on which the phylogenies argument is based, 917/ speciation (one of the mechanisms pro-

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wontin (1977) to worry about the nature of the ceteris paribus clause in any engineering analysis:

> 'In order to make the argument that a trait is an optimal solution to a particular problem, it must be possible to view the trait and the problem in isolation, all other things being equal. If other things are not equal, if a change in a trait as a solution to one problem changes the organism's relation to other problems of the environment, it becomes impossible to carry out the analysis part by part, and we are left in the hopeless position of seeing the whole organism as being adapted to the whole environment.'"

917. Platnick*, Cladograms, Phylogenetic Trees, and Hypothesis Testing, 27 Systematic Zoology 438, 441 (1978) (some "pheneticists or nonevolutionary biologists" so argue, although Platnick* does not); Cartmill*, Hypothesis Testing and Phylogenetic Reconstruction, in Zeitschrift fur Zoologische Systematik und Evolutions forschung 73 (1981) ("A single phylogenetic hypothesis forbids nothing to happen, and therefore it cannot be tested (at least in Popper's sense). . . . Popperian phylogenetic reconstruction apparently is not [possible]. It follows that the study of phylogeny is not, by Popper's criteria, a science at all.").

posed for macroevolution),918/ and some ecological concepts.919/

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918. Bush*, What Do We Really Know about Speciation?, in Perspectives on Evolution at 119, 119-20 (R. Milkman ed. 1982) ("Evolutionary biologists have not even been able to agree on a suitable definition of a species, a factor that in some respects has hindered our progress in unraveling the details of how speciation occurs in nature. . . . Ultimately, all our models must be recast in a molecular context; also, we must describe gene flow, selection, drift, and competition (and their consequences) in more exact terms. Only then can we formulate testable hypotheses of speciation. Until we know more about the molecular machinery of adaptation--that is, what is and is not possible at the molecular level--our models of speciation must remain little more than speculation based on the subjective interpretation of equivocal data.").

919. Peters*, Tautology in Evolution and Ecology, 110 American Naturalist 1, 1 (1976) ("I argue that the 'theory of evolution' does not make predictions, so far as ecology is concerned, but is instead a logical formula which can be used only to classify empiricisms and to show the relationships which such a classification implies. Similar criticisms are then made of several ecological concepts. The essence of the argument is that these 'theories' are actually tautologies and, as such, cannot make empirically testable predictions. They are not scientific theories at all.")

(ii) Partial Nontestability of Biochemical and Cosmic Evolution. Similarly, the critical element of biochemical evolution--abiogenesis--is not fully testable:

> [T]he macromolecule-to-cell transition is a jump of fantastic dimensions, which lies beyond the range of testable hypothesis. In this area all is conjecture. The available facts do not provide a basis for postulating that cells arose on this planet.920/

The same is true of an important element of cosmic evolution--the origin of matter and energy:

> Yet the origin of that cosmos and the causal principles of its history remain unexplained and inaccessible to science. Here is hidden the first cause sought by theology and philosophy.921/

The big bang hypothesis is also nontestable in part, both because it is considered a

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920. D. Green* & R. Goldberger*, Molecular Insights into the Living Process 407 (1967). Accord, Section 2[b](2) supra.

921. G. Simpson*, The Meaning of Evolution 278 (19__). Accord, Section 2[c](2) supra.

singularity and because it destroyed all evidence of its first fractional second and the prior state of the universe.922/

Conclusion. Creation-science and evolution equally meet the testability requirement for science of the McLean opinion (if it is followed), and creation-science has numerous testable claims. This is a material factual issue.

(3) Equal Falsifiability of Creation-Science and Evolution.

Overview. The falsifiability requirement, which has been criticized above,924/ is also equally met by creation-science and evolution. Both are in large part falsifiable, and both are partially unfalsifiable.

(a) Falsifiability of Creation-Science. Creation-science is substantially falsifi-

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922. Section 2[e](1)(a)(i) supra.
924. Section 2[d](3)(c) supra.

able, as one ideological opponent concedes:

> [W]e discover both (a) that creation-science is testable and falsifiable, and (b) that creation-science has been tested and falsified--insofar as any theory can he said to be falsified.925/

Each of its affirmative scientific evidences is falsifiable, just as each is testable. For example, biological creation includes the paleontology argument of the abrupt appearance of complex organisms in the fossil record and the systematic gaps between those organisms. This aspect of creation-science could be falsified by fossil evidence of a systematically nonabrupt appearance of complex life and of systematic transitional forms between fossil genera or families and higher categories. Similarly, each of the other affirmative evidences for creation-science that were

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925. Laudan*, More on Creationism, in Science, Technology and Human Values, Winter 1983, at 36, 38.

described above is clearly falsifiable as follows:

Aspect of Creation-Science	Affirmative Evidence	Falsification Method
(i) Biological creation:		
(a) Paleontology argument:	By fossils showing a systematically nonabrupt appearance of complex genera/families and higher categories, and showing systematic transitional forms between such fossil categories;	
(b) Comparative morphology argument:	By morphology analysis showing a systematic dissimilarity between fossil organisms and their modern-day counterparts, and a systematic progressive change rather than stasis;	
(c) Information content argument:	By showing that the information content of organisms plausibly could have evolved under natural laws within the generally-accepted time available;	

(d)
Probability
argument:
By showing that the probability of macroevolution of complex organisms, of all complex features and organs, and of symbiotic organisms is plausibly high under natural laws within the generally accepted time available;

(e)
Genetics
argument:
By showing that viable mutations of a scope and frequency sufficient to cross genetic barriers between genera/families and higher categories could with a high probability have occurred within the generally accepted time available;

(f)
Comparative
unrelated-
ness
argument:
By showing that anomalies in classification, comparative anatomy, and comparative biochemistry are statistically insignificant or sufficiently nonextensive to be better explained by common ancestry than by distinct ancestry;

(ii)
Biochemical
creation:

(a)
Information
content
argument:
By showing that the information content of the least complex organisms and their genetic coding systems could plausibly have evolved during generally accepted time available;

(b)
Probability
argument:
By showing that the probability of evolution of the least complex living organisms including their enzymes, proteins, and DNA is plausibly high within generally accepted time available;

(c)
Isomers
argument:
By showing that isomers of protein amino acids and nucleic acid sugars are not generally necessary to life, and could plausibly have arisen in a primordial soup or other evolutionary scenario;

(d)
Chemistry
argument:
By showing a chemical tendency toward life and toward molecules necessary for life without need for special trap mechanisms and statistical significance of that tendency;

(e)
Thermo-
dynamics
argument:
By showing a high thermodynamic probability of evolution of a first life;

(iii)
Cosmic
creation:

(a)
Thermo-
dynamics
argument:
By showing that an eternal universe would not have burned up all its hydrogen and dissipated all its complex order, or by showing a mechanism for reducing entropy in the universe;

(b)
Radiohalos
argument:
By showing a plausible method for a polonium halo to form in molten rock, or a plausible explanation for polonium to be formed on a cool earth other than from radioactive decay, or a plausible method of synthesis of granites incorporating polonium halos without uranium or thorium halos.

(c)
Information
content
argument:
By showing that the vast infor-

mation content in the universe could plausibly have evolved by natural laws;

(d) Heterogeneity argument: By showing that the heterogeneity or uneven distribution of the universe plausibly could have arisen from the big bang or other phenomenon; and

(e) Star and galaxy formation argument: By showing that the formation of galactic clusters, galaxies, stars, and solar system could plausibly have occurred under natural laws within the generally accepted time available, and is still occurring on a significant scale in the universe.

For example, for the radiohalos argument, the actual researcher on polonium halos has publicly stated in published letters in a respected science journal the specific method above of falsifying his findings and interpretations.926/ This chart makes it

clear that creation-science is falsifiable at least to the extent that evolution is.

The existence of unfalsifiable parts does not make either creation-science or evolution nonscientific. Partial unfalsifiability is possible for scientific explanations,927/ and is the case with cell theory, ecology, and sociobiology.928/ The

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926. Gentry, Letter, Physics Today, Oct. 1982, at 13, 13; Gentry, Letter, Physics Today, Apr. 1983, at 13, 13.

927. See Moore*, Science as a Way of Knowing--Evolutionary Biology, 23 American Zoologist 1, 8-9 (1983); Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 17 (1982)("It is now widely acknowledged that many scientific claims are not testable in isolation, but only when imbedded in a larger system of statements, some of whose consequences can be submitted to test.").

928. J. Moore*, Science as a Way of Knowing--Evolutionary Biology, 23 American Zoologist, 1, 8-9 (1983) ("Thus, the Cell Theory would be taken to consist of the many sorts of observations--morphological and physiological--relating to the basic units of structure and function of most living creatures. Used this way, a theory cannot be disproven. There is no way that the Cell Theory can be falsified.").

field of origins necessarily involves non-recurring past events with incomplete records, and that necessarily leads to unfalsifiable aspects.929/

(b) Limited Falsifiability of Evolution. Evolution is only partially falsifiable.

(i) Partial Unfalsifiability of Bio-

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929. Simpson* refers to "historical biologists" in fields such as paleontology and paleobiology. G. Simpson*, The Major Features of Evolution 338 (1953). Similarly, geology, origin of life biochemistry, cosmology, and forensic scientific fields are historical sciences. The "evolutionary happenings" of paleontology and paleobiology are "unique, unrepeatable, and irreversible." Dobzhansky*, On Methods of Evolutionary Biology and Anthropology, 45 American Scientist 381, 388 (1957). See also T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 8 (1977). The evolutionary events of cosmic evolution and biochemical evolution similarly involve singularities, or unique events, which would have destroyed much of the evidence in the case of the big bang and would not have left evidence in the case of the origin of the first life. Section 2[e](1)(a)(i) supra. Hence, explanations in these fields are partially unfalsifiable.

logical Macroevolution. Sir Karl Popper*, the philosopher of science who developed the falsification concept, himself has argued that evolution is not falsifiable at least in large part.930/ If the Popperian requirement of falsification is adopted,

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930. Popper*, Intellectual Autobiography, in 2 The Philosophy of Karl Popper 3, 134, 137 (P. Schilpp ed. 1974). Accord, C. Patterson*, Evolution 147 (1978) ("Using Popper's criterion, we must conclude that evolutionary theory is not testable in the same way as a theory in physics, or chemistry, or genetics, by experiments designed to falsify it."); Eden*, _____, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution 71, (P. Moorhead & M. Kaplan eds. 1967) ("It can, indeed, explain anything. You may be ingenious or not in proposing a mechanism which looks plausible to human beings and mechanisms which are consistent with other mechanisms which you have discovered, but it is still an unfalsifiable theory."); Sparkes*, What Is This Thing Called Science?, 89 New Scientist 156, 158 (1981) ("This unpredictability, of course, makes experimental falsification of the theory [of evolution] very difficult, and so, by Popper's criterion, leaves the scientific status of the theory unsure."); Weisskopf*, Discussion, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution

the Popperian conclusion should also be followed that macroevolution is largely unfalsifiable. The same conclusion, that biological macroevolution or natural selection is unfalsifiable, has been reached by many

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__, 64 (P. Moorehead & M. Kaplan eds. (1967) ("I think it was Medawar who said that one thing about the theory of evolution is (and he quoted Popper) that is it not falsifiable, that whatever happens you can always explain it."); Birch* & Ehrlich*, Evolutionary History and Population Biology 216 Nature 349, 352 (1967) ("Our theory of evolution has become . . . one which cannot be refuted by any possible observations. It is thus 'outside of empirical science,' but not necessarily false."); Bethell, Darwin's Unfalsifiable Theory, Kronos, Summer 1982, at 33, 34, 36 ("The scientist, or the philosopher of science, might put the problem with Darwin's theory this way. No event, or observation in nature, could conceivably demonstrate that the theory was false. To some this might at first seem to be a strength rather than a weakness of the theory, but in fact of course a theory that cannot be falsified in principle is not 'true' but rather a semantically disguised statement of the type 'all apples are apples'. Darwin's theory has been overthrown. And in fact no experimental observation will ever lead to such a claim, precisely because Darwin's theory is immune--logically immune--to falsification.").

other philosophers and scientists including the following ones discussed in this Section:

Eden*	Brady*
Saunders*	Gromko*
Ho*	Wassermann*
Patterson*	Ehrlich*
Sparkes*	Bethell
Weisskopf*	Cartmill*
Wald*	Peters*
Birch*	

Furthermore, because "tautologies are not subject to empirical falsification,"931/ most of the scientists and philosophers cited earlier who argue that macroevolution or natural selection is a tautology would also conclude that one or both is unfalsifiable.

An example is the recent analysis of Saunders* and Ho* that concludes that the neo-Darwinian approach is unfalsifiable:

> Neo-Darwinism, the theory that evolution can be adequately explained

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931. Peters*, Tautology in Evolution and Ecology, 110 American Naturalist 1, 2, (1976).

> in terms of the natural selection of random variations, is not falsifiable. Many of the potential falsifiers that have been suggested turn out to be tests not of Neo-Darwinism but of something else, frequently of the hypothesis that evolution has occurred. Others, such as those having to with nonadaptedness and gradualism, are inherently incapable of providing conclusive tests. The remainder . . . are so hedged about the qualifications as to make the theory invulnerable.
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> . . . .
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> The synthetic theory possesses a remarkable elasticity: when under attack it expands to include almost anything, but once the pressure is relaxed it contracts to the definition given by Maynard Smith.932/

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932. Saunders* & Ho*, Is Neo-Darwinism Falsifiable?--And Does It Matter?, 4 Nature and System 179, 191 (1982). Accord, id. at 180 ("The synthetic theory possesses a remarkable elasticity: when under attack it expands to include almost anything, but once the pressure is relaxed it contracts to the definition given by Maynard-Smith."); Eldredge* & Gould*, Punctuated Equilbria: An Alternative to Phyletic Gradualism, in Models in Paleobiology at 82, 90 (J. Schopf ed. 1972) ("We have all heard the traditional response so often that it has become imprinted as a catechism that brooks no analysis: the fossil record is extremely imperfect. . . . This traditional approach to morphological breaks merely underscores what Feyerabend meant (see above) in compar-

One aspect of biological macroevolution that has been analyzed as unfalsifiable is natural selection,933/ and another such aspect

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ing theories to party lines, for it renders the picture of phyletic gradualism virtually unfalsifiable."); Wald*, Discussion, in Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution, ___, 71 (P. Moorhead & M. Kaplan eds. 1967) ("It can, indeed, explain anything. You may be ingenious or not in proposing a mechanism which looks plausible to human beings . . . but it is still an unfalsifiable theory.").

933. Brady*, Natural Selection and the Criteria by Which a Theory is Judged, 28 Systematic Zoology 600, 600 (1979) ("[M]ost recent critics have already understood this and are actually arguing that the theory is not falsifiable in its operational form. Under examination, the operational forms of the concepts of adaptation and fitness turn out to be too indeterminate to be seriously tested, for they are protected by ad hoc additions drawn from an indeterminate realm."); Bethell, Darwin's Unfalsifiable Theory, Kronos, Summer 1982, at 33, 34 ("Once this point is clarified, we can see that the analogy between biology and engineering breaks down, because evolutionary biology as currently set forth by such experts as Gould himself does not recognize the idea that animals have any ultimate function other than to survive and leave offspring. It can plausibly be argued from an engineer's standpoint that various birds are badly designed--ostriches and flamin-

is the related concept of adaptation.934/ Similar arguments have been made about phylogenetic hypotheses (evolutionary trees),935/ and can be made about convergences and parallelisms and evolutionary treatment of other anomalies.

(ii) Partial Unfalsifiability of Biochemical and Cosmic Evolution. Biochemical evolution and cosmic evolution also are in-part unfalsifiable, both because they in

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goes, for example--but if they succeed in surviving and leaving offspring, as they do, who is to say that they are defective from an engineer's point of view?").

934. G. Wassermann*, Testability of the Role of Natural Selection within Theories of Population Genetics and Evolution, 29 British Journal of Philosophy of Science 223, 223-24 (1978) ("neither these ad hoc hypotheses nor their specially postulated linkage with theories of general mechanisms are falsifiable.").

935. Cartmill*, Hypothesis Testing and Phylogenetic Reconstruction, in Zeitschrift fur Zoologishe Systematik und Evolutionsforschung 73, 90 (1981) ("We may, I think, conclude from all this that phylogenetic hypotheses are not falsifiable in Popper's sense of the word.")

volve singularities and because they involve limited evidence (evolution of the first life would not leave fossil or other remains, and the evolutionary big bang would have destroyed some of its own manifestations).936/ For the big bang and similar explanations, "in the nature of the case neither group can be verified or falsified in any observationally direct manner."937/

Summary. Thus, creation-science and evolution equally meet the McLean requirement of falsifiability for science, with creation-science having numerous falsifiable claims but with neither explanation being fully falsifiable. This is a material factual issue.

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936. Section 2[e](1)(a)(i) supra.

937. Hepburn*, Creation, Religious Doctrine of: Creation in the Context of Scientific Cosmological Theories, 2 Encyclopedia of Philosophy 255, 255 (P. Edwards ed. 1967).

(4) Equal Tentativeness of Creation-Science and Evolution.

Overview. The tentativeness requirement of the McLean decision, which has been criticized above as erroneous and as simply not a normal characteristic of science,940/ is at least equally met by creation-science and evolution. In fact, a strong argument may be made that creation-science is generally far more tentatively held by most creationist scientists than evolution is held by most evolutionists, in view of the insistence of many leading evolutionists on calling evolution a "fact" and in view of the emotional zeal of many evolutionists in defending evolution and attacking creation-science. Leach* makes that observation (Sedgwickians were early creationists):

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940. Section 2[d](3)(d) supra.

> [T]oday it is the conventional neo-Darwinians who appear as the conservative bigots and the unorthodox neo-Sedgwickians who rate as enlightened rationalists prepared to contemplate the evidence that is plain for all to see.941/

(a) Tentativeness of Creation-Science.

The equal tentativeness (or revisability) of creation-science and evolution has been noted by Professor Larry Laudan*:

> Judge Overton's third worry about Creationism centers on the issue of revisability. Over and over again, he finds Creationism and its advocates "unscientific" because they have refuse[d] to change it regardless of the evidence developed during the course of the[ir] investigation." In point of fact, the charge is mistaken. If the claims of modern-day creationists are compared with those of their nineteenth-century counterparts, significant shifts in orientation and assertion are evident. One of the most visible opponents of Creationism, Stephen Gould, concedes that creationists have modified their views about the amount of variability allowed at the level of species change. Creationists do, in short, change their minds

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941. Leach*, Men, Bishops and Apes, Nature, Sept. 3, 1981, at 19, 20.

> from time to time. Doubtless they would credit these shifts to their efforts to adjust their views to newly emerging evidence, in what they imagine to be a scientifically respectable way.
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> . . . .
>
> Even worse, the ad hominem charge of dogmatism against Creationism egregiously confuses doctrines with the proponents of those doctrines. . . . What counts is the epistemic status of Creationism, not the cognitive idiosyncrasies of the creationists. Because many of the theses of Creationism are testable, the mindset of creationists has no bearing in law or in fact on the merits of Creationism.942/

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942. Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 17 (1982). He also states:

> Well, that tells us something interesting about the psychology of creationists, but it has no bearing whatever on an assessment of their doctrines. After all, when confronted by comparable problems in other walks of life, we proceed exactly as I am proposing, that is, by distinguishing beliefs from believers. When, for instance, several experiments turn out contrary to the predictions of a certain theory, we do not care whether the scientist who invented the theory is prepared to change his mind. We do not say that his theory cannot be tested, simply because he refuses to accept the results

Thus, the faults of creationist scientists are a different issue from its scientific nature, and creation-science has indeed been tentative enough to change.943/

(b) Nontentativeness and Dogmatism of Evolution. By contrast, evolution is generally or at least often proclaimed dogmatically and nontentatively. This is evident in the many strong affirmations of the most committed evolutionists, such as Sagan*, that "evolution is a fact, not a theory."944/

> of the test. . . . In just the same way, the soundness of creation-science can and must be separated from all questions about the dogmatism of creationists.

Laudan*, More on Creationism, in Science, Technology, and Human Values, Winter 1983, at 36, 37-38.

943. Id. See also, Alexander*, Evolution, Creation, and Biology Teaching, in Evolution versus Creationism at 90, 92, 102 (P. Zetterberg ed. 1983) (admitting that "[c]reationist arguments can also be shown to involve significant retreats," while interpreting that to indicate untenable hypotheses).

944. C. Sagan*, Cosmos 27 (1980) (emphasis in original).

Lewontin* recently called for evolutionists "to state clearly that evolution is a fact, not theory," while deriding the "creationists know-nothings."945/ The National Association of Biology Teachers (comprising mostly public high school teachers) published a list of assertions that evolution is a "fact,"946/ while public high school

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945. Lewontin*, Evolution/Creation Debate: A Time for Truth, 31 BioScience 559 (1981).

946. These are as follows:

Sir Julian Huxley (1960): . . . The evolution of life is no longer a theory; it is a fact and the basis of all our thinking.

Ernst Mayr . . . (1976): That evolution is a fact and that the astonishing diversity of animals and plants evolved gradually was accepted quite universally soon after 1859. George Gaylord Simpson (1951): . . . he finally and definitely established evolution as a fact, no longer speculation or an alternative hypothesis for scientific investigation.

. . . .

G. Ledyard Stebbins (1977): The origins of races and species by evolution is a demonstrated fact supported by experimental evidence as strong as the evi-

textbooks often make assertions that there is "no longer any reasonable doubt that evolution occurs."947/ Incidentally, biological Macroevolution is not generally regarded as a fact, but "its explanation on the basis of recognized processes is still

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dence for the existence of atoms, electrons, protons, and other particles of matter.

Theodosius Dobzhansky (1951): Evolution as a historical process is established as thoroughly and completely as science can establish facts of the past witnessed by no human eyes.

Donald C. Johanson (1981): Evolution is, I believe, firmly established as a scientific fact.

Ashley Montague (1981): . . . the truth is that evolution is an irrefutable fact . . .."

Hughes*, The Fact and the Theory of Evolution, 44 American Biology Teacher 25, 27 (1982). That list is reminiscent of past scientific statements on many subjects, such as Haeckel* that the "existence of ether (or cosmic ether) as a real element is a positive fact" (which Einstein* disproved). E. Haeckel*, The Riddle of the Universe ____(1900) (emphasis in original).

947. Biological Sciences Curriculum Study*, Biological Science: Molecules to Man (1st ed. 1961) (very significant textbook series).

in the stage of partly demonstrated theory or, in the case of the origin and early differentiation of the first cellular organisms, a working hypothesis," in the words of leading evolutionists Dobzhansky*, Ayala*, Stebbins* and Valentine*.948/

This dogmatism has led many evolutionists and noncreationists to criticize the "religious fervor" of some outspoken evolutionists:

> To-day the tables are turned. The modified, but still characteristically Darwinian theory has itself become an orthodoxy, preached by its adherents with religious fervour, and doubted, they feel, only by a few muddlers imperfect in scientific faith.949/

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948. T. Dobzhansky*, F. Ayala*, G. Stebbins*, & J. Valentine*, Evolution 5 (1977). The Hughes* article, note 946 supra, evidently quoted other statements of Dobzhansky* and Stebbins* out of context.

949. Grene*, The Faith of Darwinism, Encounter, Nov., 1959, at 48, 49. Accord, H. Lipson*, A Physicist Looks at Evolution, 31 Physics Bulletin 138, 138 (1980) ("In fact, evolution became in a sense a scientific religion; almost all scientists have

It has led others to decry that dogmatism as "unhealthy":

> What is at stake is not the validity of the Darwinian theory itself, but of the approach to science that it has come to represent. The peculiar form of consensus the theory wields has produced a premature closure of inquiry in several branches of biology, and even if this is to be expected in

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accepted it and many are prepared to 'bend' their observations to fit in with it."); S. Jaki*, Cosmos and Creator ___ (1982) ("Darwinism is a creed not only with scientists committed to document the all-purpose role of natural selection. It is a creed with masses of people who have at best a vague notion of the mechanism of evolution as proposed by Darwin, let alone as further complicated by his successors."); C. Patterson*, Evolution 150 (1977) ("Popper warns of a danger: 'A theory, even a scientific theory, may become an intellectual fashion, a substitute for religion, an entrenched dogma.' This has certainly been true of evolutionary theory."); N. Macbeth*, Darwin Retried 126-27 (1971) ("Darwinism itself has become a religion."); R. Jastrow*, God and the Astronomers 113 (1978) ("There is a kind of religion in science; it is the religion of a person who believes there is order and harmony in the Universe, and every event can be explained in a rational way as the product of some previous event; every effect must have its cause; there is no First Cause.").

> 'normal science,' such a dogmatic approach does not appear healthy.950/

And it has led Stansfield* to state in his college evolution textbook that "[p]erhaps the greatest contribution creationists are currently making to science is their recognition of 'creeping dogmatism' in the science of evolution."951/

Summary. The tentativeness criterion, if it is not discarded, is met by creation-science far better than it is met by evolution.

Conclusion. Thus, even if the erroneous McLean definition is accepted, creation-science meets the McLean definition of science equally well with evolution. Yet

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950. Brady*, Dogma and Doubt, 17 Biological Journal of the Linnaean Society 79, 95-96 (1982). Accord, F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 25 (1983)(chapter 2: "The Gospel According to Darwin . . . A New Dogma").

951. W. Stansfield*, The Science of Evolution 11 (1977).

the "core issue is not whether Creationism satisfies some undemanding and highly controversial definitions of what is scientific; the real question is whether the existing evidence provides stronger arguments for evolutionary theory than for Creationism"952/ --or at least whether scientific evidence is the content of creation-science.953/ This involves several material factual issues.

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952. Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 18 (1982).

953. Although a prediction requirement is similarly not an "essential characteristic of science," note 739 supra, it also would be equally met by creation-science and evolution. Neither explanation may claim predictive credit for all consistent data:

> Theories, qua theories, simply cannot be given predictive credit for everything they agree with. They can never be uniquely responsible for an entire canon (of known facts in field) but share this with any number of possible contenders. We are speaking here, of course, of theories as postulations whose relation to the world is yet to be determined. Once we are convinced that we know that relation, however,

f. Material Factual Issue that the Sole Alternatives are Creation-Science and Evolution.

> and that the theory in question is true, we may indeed assign it complete responsibility for the canon, discarding all other explanations, for it is not identified with reality. Since Maynard-Smith argues that to postulate counter-examples to his understanding of neo-Darwinism we should have to imagine the world quite otherwise than it is, he has evidently taken the step in question. Predictably, any audience sharing his belief will be unlikely to notice that no empirical support can result from the procedure.

Brady*, Dogma and Doubt, 17 Biological Journal of the Linnaean Society 79, 91 (1982). Macroevolution has only limited predictive capability. D. Hull*, Philosophy of Biological Science ___(1974) ("The evolutionary development of a particular species or population as such cannot be predicted with any reasonable degree of certainty."); Peters*, Tautology in Evolution and Ecology, 110 American Naturalist 1, 1 (1976) ("The essence of the argument is that these 'theories' are actually tautologies and, as such, cannot make empirically testable predictions. They are not scientific theories at all."); Mayr*, Cause and Effect in Biology, 134 Science, 1501, 1504 (1961) ("The theory of natural selection can describe and explain phenomena with considerable precision, but it cannot make reliable predictions."); N. Macbeth*, Darwin Retried 103 (1971) ("modern evolutionists admit that Darwinism has no predictive power").

Summary. The sole alternative scientific explanations of the origin of the universe, life, and plants and animals are creation-science and evolution. The McLean opinion reached the opposite conclusion:

> Creationists have adopted the view of Fundamentalists generally that there are only two positions with respect to the origins of the earth and life: belief in the inerrancy of the Genesis story of creation and of a worldwide flood as fact, or belief in what they call evolution.
>
> The two model approach of the creationists is simply a contrived dualism which has no scientific factual basis or legitimate educational purpose. It assumes only two explanations for the origins of life and existence of man, plants and animals. . . .956/

However, the view that there are only two scientific positions is derived from the view of many evolutionist scientists and philosophers rather than from Fundamentalists, such as the following:

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956. McLean v. Arkansas Board of Education, 529 F.Supp. 1255, 1266, 1266 (E.D. Ark. 1982).

Huxley* (who named the neo-Darwinian synthesis)
Wald* (Nobel Prize recipient)
Jastrow* (professor of astronomy at Columbia)
Futuyma*
Alexander*
Soloman*
Leslie*
Simon*
Hoagland*
Jennings*
Thompson*
Hoyle
Hunter*
Heutschell*
Cook*
Watson*
Newman*
Russell*

Thus, this is not merely a "contrived dualism," but a view widely held among evolutionists.

A typical evolutionist acknowledgement that creation-science and evolution are the only possible scientific alternatives is made by Futuyma* (in a recent anticreationist book), as well as by other scientists and science educators:

> Creation and evolution, between them, exhaust the possible explanations for the origin of living things. Organisms either appeared on the earth fully developed or they did not. If they did not, they must have developed from preexisting species by some process of modification.957/

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957. D. Futuyma*, Science on Trial

Other examples are the statements of Nobel

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198 (1983). Accord, A. Thompson*, Biology, Zoology, and Genetics 1 (1983) ("There are two doctrines regarding biological change--the doctrine of evolution and the doctrine of special creation."); Alexander*, Evolution, Creation, and Biology Teaching, in Evolution versus Creationism at 90, 91 (P. Zetterberg ed. 1983) ("indeed, at this moment creation is the only alternative to evolution."); Huxley*, Evolution: The Modern Synthesis 473 (1942) ("if we repudiate creationism divine or vitalistic guidance, and the extremer forms of orthogenesis, as originators of adaptation, we must (unless we confess total ignorance and abandon for the time any attempts at expansion) invoke natural selection."); P. Davis* & E. Solomon*, The World of Biology 395 (1974)("Such explanations tend to fall into one or the other of two broad categories: special creation or evolution. Various admixtures and modifications of these two concepts exist, but it seems impossible to imagine an explanation of origins that lies completely outside the two ideas."); F. Hoyle & N. Wickramasinghe, Evolution from Space 86-87 (1981) ("We can only explain the absence of intermediate insect forms in the fossil record either by supposing the different insect orders to be of separate origin or by arguing that the divergencies from the common stock indicated at the base of Figure 6.4 took place with extreme rapidity. Only the second of these possiblities is consistent with Darwinism, yet rapid expansion is just what Darwinism cannot achieve."); Wald*, The Origin of Life, Scientific American,

Prize recipient Wald* and of several philo-

Aug. 1954, at 44, 46; G. Hunter* & F. Hunter*, College Zoology 687 (1949)("Either the present day forms began as such and have continued to exist in their original form, or life may have started in one common form from which all the others may have developed."); C. Heutschell* & W. Cook*, Zoology for Medical Students 684 (1947) ("[T]wo theories have been propounded. The traditional idea was that of special Creation, in which all organisms as we know them today were invented and made in the beginning of time with the same structure as we now find them. . . . The facts of biology, however, do not allow us to accept this view. The modern view is that of Organic Evolution."); H. Newman*, Evolution, Genetics, and Eugenics 51 (1932) ("There is no rival hypothesis except the outworn and completely refuted idea of special creation, now retained only by the ignorant, the dogmatic, and the prejudiced."); Watson*, Adaptation, 124 Nature 233 (1929) ("If so, it will present a parallel to the theory of evolution itself, a theory universally accepted not because it can be proved by logically coherent evidence to be true but because the only alternative, special creation is clearly incredible."); Jennings*, _____, in Creation by Evolution 32 (1928) ("Remember that there are two opposite doctrines. One holds that the constitution of organisms is permanent; that they were created as they are and do not change. The other, the doctrine of evolution, holds . . .."); J. Teller*, Louis Agassiz, Scientist and Teacher 263 (1947)

sophers:

> The reasonable view was to believe in spontaneous generation; the only alternative to believe in a single, primary act of supernatural creation. There is no third position. Most modern biologists, having reviewed with satisfaction the downfall of the spontaneous generation hypothesis, yet unwilling to accept the alternative belief in special creation, are left with nothing.958/

("The concept of development was accordingly untrue, and special creation remained the only valid interpretation."); see R. Jastrow*, Until the Sun Dies 51-52 (1977) ("Perhaps the appearance of life on the earth is a miracle. Scientists are reluctant to accept that view, but their choices are limited; either life was created on the earth by the will of a being outside the grasp of scientific understanding, or it evolved on our planet spontaneously, through chemical reactions occurring in a non-living matter lying on the surface of the planet."); M. Simon*, The Matter of Life 162 (1971) ("If life was not created supernaturally, and if it did not simply develop from preexistent 'seeds' present from the creation of the universe (whenever that was), life must have come forth from nonliving matter."); Hoagland*, The Elements of Life, in

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at ___, 151 (19__) ("[There are] only two answers to the question of how life began. It must either have arisen spontaneously from non-living material or have been cre-

Each aspect of creation-science and evolution poses the same logical choice between two scientific alternatives. (i) In considering the origin of plants and animals, either the various genera/families and higher categories appeared abruptly without common ancestry (biological creation) or they emerged through eventually progressive change (such as from simple organisms to fish to amphibia to reptiles to birds and mammals to primates to man--

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ated by supernatural means."). We do not agree with the definition of creation-science or "creationism" given by Thompson*, Jastrow*, Simon*, and Hoagland*; and want to specify that Futuyma*, Thompson*, Jastrow*, Hoagland*, and some others specifically argue that "creationism" is not scientific.

958. Wald*, The Origin of Life, in Physics and Chemistry of Life at 3, 5 (1955). Accord, Leslie*, Cosmology, Probability, and the Need To Explain Life, in Scientific Explanation and Understanding 53, 57 (N. Rescher ed. 1983); Russell*, Why I am not a Christian, in The Basic Writings of Bertrand Russell at 589 (R. Egner & L. Dennon eds. 1961).

[PAGES 710-718 INTENTIONALLY OMITTED]

biological macroevolution).959/ This assumes that they have not existed forever in their current form (which all scientists of all viewpoints reject). (ii) In considering the origin of the first life, either it appeared abruptly in complex form (biochemical creation) or it emerged through progressive change from amino acids to biopolymers to protocells to the first life (biochemical evolution).960/ (iii) In considering the origin of the universe, either the galaxy clusters and galaxies and stars appeared abruptly in their present complex form cosmic creation) or they reached their present

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959. D. Futuyma*, Science on Trial 197 (1983); A. Thompson*, Biology, Zoology, and Genetics 1 (1983); G. Hunter* & F. Hunter*, College Zoology 687 (1949).

960. Wald*, The Origin of Life, in Physics and Chemistry of Life at 3, 5, (155); R. Jastrow*, Until the Sun Dies 51-52 (1977); M. Simon*, The Matter of Life 162 (1971); H. Hoagland*, The Elements of Life in ibid., p. 151.

complex form through progressive change from a big bang or similar phenomenon (cosmic evolution).961/ Within each of these pairs of two scientific alternatives, there are many subviews, such as the neo-Darwinian synthesis and punctuated equilibria for biological evolution, and creation of genera/families and directed panspermia for biological creation.962/ Of course, the Louisiana statute does not restrict instruction in a third scientific alternative, if it ever were formulated, or in variants of the two present alternatives.

Theistic evolutionists often have ad-

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961. Leslie*, Cosmology, Probability, and the Need to Explain Life, in Scientific Explanation and Understanding 53, 54 (N. Rescher ed. 1984).

962. Several recent books on directed panspermia describe it as creation. F. Hoyle & N. Wickramasinghe, Evolution from Space: A Theory of Cosmic Creation (1981); F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution ___ (1983); Section 3[b](1)(c) infra.

vocated a position that God began and perhaps directed the evolutionary process. This is not a third position, but instead combines cosmic creation with biological evolution. It is not a scientific explanation, because it usually involves an interpretation of Genesis and concepts of the human soul, although it certainly is one possible religious viewpoint.

Because creation-science and evolution are the sole scientific alternatives, evidence against one is evidence for the other, and any scientific evidence that renders evolution less plausible renders creation-science more plausible. The McLean opinion disagreed:

> [A]ccording to creationists, . . . all scientific evidence which fails to support the theory of evolution is necessarily scientific evidence in support of creationism 963/

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963. McLean v. Arkansas Board of Education, 529 F. Supp. at 1266.

However, evolutionists also often argue that evidence against evolution is evidence for creation-science, such as Alexander* in an anti-creationist anthology:

> Creation and evolution in some respects imply backgrounds about as different as one can imagine. In the sense that creation is an alternative to evolution for any specific question, case against creation is a case for evolution and vice versa.964/

However, our position does not depend on this premise or on presentation of negative evidences against evolution, but instead is based on presenting affirmative evidences for creation-science as analyzed above.965/

Conclusion. The discussion above demonstrates that creation-science is as scientific as evolution. Sections [a] through [c] above have demonstrated that creation-

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964. R. Alexander*, Evolution, Creation, and Biology Teaching, in Evolution versus Creationism 90, 91 (J. Zetterberg ed. 1983).

965. Sections 2[a](1), 2[b](1), and 2[c](1) supra.

science is scientific and evolution is not compelling in each area of origins. These are material factual issues. Sections [d] and [e] above have shown that creation-science meets the most widely accepted definitions of science, and even meets the erroneous McLean definition. These are also material factual issues. Actually, the Defendants in order to prevail do not need to show creation-science is equally scientific, or even that it is scientific at all, but simply that it is nonreligious within the meaning of the establishment clause. However, the above assessment of the empirical evidence and scientific interpretations that comprise creation-science is very helpful in establishing that creation-science is nonreligious as well as that it is scientific. The following Sections will argue that creation-science is not only scientific but also nonreligious.

3. MATERIAL FACTUAL ISSUE THAT CREATION-SCIENCE IS AS NON-RELIGIOUS AS EVOLUTION

Summary. Creation-science is as nonreligious as evolution, as well as being as scientific as evolution. The question of whether creation-science is religious is a factual question,970/ which in turn includes many more specific factual issues. Section [a] discusses the definition of religion, which conflicts with the implied McLean definition. Section [b] discusses the nonreligious nature of a creator and of creation in the context of empirical evidence and scientific interpretations, arguing that the concepts of creation and a creator are not inherently religious, and that the concept of a creator is not central to crea-

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970. E.g., Brown v. Dade Christian Schools, Inc., 556 F.2d 310, 314 (5th Cir. 1977) (en banc), cert. denied, 434 U.S. 1063 (1978).

tion-science and in fact has a parallel nonreligious relation to evolution. Section [c] discusses the nonreligious nature of other parallels between evolution and creation-science, including parallel consistency with various religions, parallel spokesmen with strong religious beliefs, etc. Section [d] focuses on history and discusses the nonreligious nature of the parallel history of religious involvement in the creation-evolution controversy on each side. Finally, Section [e] addresses current history and considers the nonreligious nature of the parallel political activity on behalf of evolution and creation-science. These points will be supported by the State's expert testimony in philosophy and theology at trial, and all are material factual issues.

All of this discussion should be considered in light of the clear legal issues

that the establishment clause of the First Amendment permits reference to creation or a creator in public school science classes under unanimous court decisions,971/ and that the establishment clause does not require a total wall of absolute separation between church and state,972/ as well as that the purpose and effect of balanced treatment for creation-science and evolution are advancing academic freedom and providing more scientific information,973/ as discussed later in this Brief.

a. Material Factual Issues that the Accepted Definition of Religion Conflicts with the McLean Definition

Summary. The critical definition of religion is the constitutional definition under the establishment clause, which is

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971. Part B, Section 2[a]-[b] infra.
972. Part B, Section 2[f] infra.
973. Part B, Section 2[c]-[e] infra.

discussed at length below.974/ It is a crucial factual issue that creation-science is as nonreligious as evolution within this definition.

Judicial Definitions. The U. S. Supreme Court has defined "religion" as involving any "ultimate concern" and as not being centered in and not even requiring belief in God or a Supernatural Being, both in cases construing the establishment clause975/ and in cases involving statutory interpretation of the term "religion."976/

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974. Part B, Section 2[a](2) infra.

975. Torcaso v. Watkins, 367 U.S. 488, 495 n. 11 (1961) (nontheistic religions); Everson v. Board of Education, 330 U.S. 1, 16 (1947) (protection of "Non-believers").

976. Gillette v. United States, 401 U. S. 437, ____ (1971); Welsh v. United States, 398 U.S. 333 (1970); United States v. Seeger, 380 U.S. 163, 166 (1965)(ethical creed with skepticism toward existence of God). Accord, Alston*, Religion, in 7 Encyclopedia of Philosophy 140, 142 (P. Edwards ed. 1967) ("Beliefs in supernatural beings can be whittled away to nothing, as

The lower federal courts have followed this approach , as further discussed in Part B, below.977/

Philosophy of Religion Definitions. The definitions of "religion" given by the field of philosophy of religion also do not treat religion as most centrally involving God or a Supernatural Being, but as being centered in "ultimate concern" and as involving many factors. For example, the Encyclopedia of Philosophy article on religion states that not just one but many of nine characteristics are necessary for something to be religious, and that "is as precise as we can be":

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in certain forms of Unitarianism, or may never be present, as in certain forms of Buddhism.").

977. Part B, Section 2[a](2) infra.

Characteristic features of religion. Despite the fact that none of the definitions specifies a set of characteristics which is present when and only when we have a religion, or gives us a unique essense, it does seem that they contribute to our understanding of the nature of religion. It appears that the presence of any of the features stressed by these definitions will help to make something a religion. We might call such features, listed below, religion-making characteristics.

1. Belief in supernatural beings (gods).
2. A distinction between sacred and profane objects.
3. Ritual acts focused on sacred objects.
4. A moral code believed to be sanctioned by the gods.
5. Characteristically religious feelings (awe, sense of mystery, sense of guilt, adoration), which tend to be aroused in the presence of sacred objects and during the practice of ritual, and which are connected in idea with the gods.
6. Prayer and other forms of communication with gods.
7. A world view, or a general picture of the world as a whole and the place of the individual therein. This picture contains some specification of an overall purpose or point of the world and an indication of how the individual fits into it.
8. A more or less total organization of one's life based on the

world view.

9. A social group bound together by the above.

Definition in terms of characteristics. If it is true that the religion-making characteristics neither singly nor in combination constitute tight necessary and sufficient conditions for something being a religion, and yet that each of them contributes to making something a religion, then it must be that they are related in some looser way to the application of the term. Perhaps the best way to put it is this. When enough of these characteristics are present to a sufficient degree, we have a religion. It seems that, given the actual use of the term "religion," this is as precise as we can be. If we tried to say something like "for a religion to exist, there must be the first two plus any three others," or "for a religion to exist, any four of these characteristics must be present," we would be introducing a degree of precision not to be found in the concept of religion actually in use.978/

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978. Alston*, Religion, in 7 Encyclopedia of Philosophy 140, 141-42 (P. Edwards ed. 1967). He also notes the danger of opportunistic definitions of religion. Id. at 142 ("Each party to the dispute will appeal to a definition suited to the position he is defending, and since none of these definitions is wholly adequate, there is an irreducible plurality of not wholly inade-

The Encyclopaedia Britannica definition is similar in listing as the "essence or core of religion" a "moment of vision and disclosure," and giving as "subjective and objective aspects of religion" the characteristics of faith, prayer, ritual, mystery, public worship, sacralization, and often belief in salvation.979/ The Oxford English Dictionary similarly gives seven definitions, of which only the third and fifth involve a Supreme Being, and then only define belief in a Supreme Being to be religious when accompanied by other charac-

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quate definitions to be used for this purpose. Person A, who claims that communism is a religion, will give, for instance, Caird's statement as his definition of religion, and person B, who denies this, will choose Martineau's. Obviously, the position of each is upheld by his chosen definition.").

979. Ramsey*, Religion, Philosophy of, 15 Encyclopaedia Britannica 592, 594 (15th ed. 1974) (the latter two characteristics come under "[e]ffects of religious beliefs and practices").

teristics.980/ Typical definitions given

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980. The full definitions (without etymology) are as follows:

Religion . . ..

1. A state of life bound by monastic vows; the condition of one who is a member of a religious order, esp. in the Roman Catholic Church.

2. A particular monastic or religious order or rule; a religious house. Now rare.

3. Action or conduct indicating a belief in, reverence for, and desire to please, a divine ruling power; the exercise or practice of rites or observances implying this. Also pl., religious rites. Now rare, exc. as implied in 5.

4. A particular system of faith and worship.

5. Recognition on the part of man of some higher unseen power as having control of his destiny, and as being entitled to obedience, reverence, and worship; the general mental and moral attitude resulting from this belief, with reference to its effect upon the individual or the community; a personal or general acceptance of this feeling as a standard of spiritual and practical life. . . .

6. transf. ta. Devotion to some principle; strict fidelity or faithfulness; conscientiousness; pious affection or attachment. Obs. . .

7. The religious sanction or obligation of an oath, etc. Obs.

by other philosophers of religion are the "ultimate concern" of Tillich* (adopted by the U.S. Supreme Court)981/ or the "vision of something which stands beyond, behind, and within, the passing flux of immediate things" of Whitehead.982/ None of these definitions equates religion solely or necessarily with belief in God or a Supreme Being, and each of these definitions finds belief in God nonessential to religion.

Creation-Science. Creation-science simply does not constitute such an "ultimate concern" or religious belief system as required by these definitions. It lacks most or all of the nine characteristics of the Encyclopedia of Philosophy definition,

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981. P. Tillich*, _____, followed in Religion, 8 Oxford English Dictionary 410 (1961). Torcaso v. Watkins, 367 U.S. 488, ____ (1961) and United States v. Seeger, 380 U.S. 163, ___ (1965).

982. A. Whitehead*, Science and the Modern World 191 (1925).

lacks all the aspects of the Encyclopaedia Britannica definition, and does not fully meet any of the seven Oxford English Dictionary definitions. Creation-science is not a religious concept, but instead consists of empirical evidence and scientific interpretations, without any reference to or reliance on religious texts and doctrines.983/ Recognition of the scientific evidence supporting creation can be and has been based entirely on non-relig;ous grounds, as several Agnostic expert witnesses will testify at trial; and the concept of a creator is not a central part of creation-science itself when properly defined, as discussed below.

McLean Definition. The McLean opinion does not define religion, except by saying

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983. Sections 2[a](1), 2[b](1), and 2[c](1) supra.

that a concept that is not scientific must be religious:

> Since creation-science is not science, the conclusion is inescapable that the only real effect of Act 590 is the advancement of religion.984/

The incorrectness of this approach is universally recognized by philosophers, judges, and theologians. One philosopher writes:

> [T]hey lead Judge Overton ultimately to the claim, specious in its own right, that since Creationism is not "science," it must be religion.985/

Another federal judge recently noted that "[m]erely because science cannot answer a question does not mean that that question is thrown into the realm of religion for purposes of the Establishment Clause, and this holds true even if theologians label

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984. McLean v. Arkansas Board of Education, 529 F. Supp. 1255, 1272 (E.D. Ark. 1982).

985. Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, ___ (1982).

the question religious."986/ Otherwise, philosophy and literature (which are not scientific) would be religious. Creation-science, even if not scientific, is not religious within the establishment clause. This is a material factual issue.

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986. Womens Services, P.C. v Thone, 483 F. Supp. 1022, 1036 (D. Neb. 1979); see Harris v. McRae, 448 U.S. 297, 319 (1980).

b. Material Factual Issues that Creation-Science and Evolution Are Equally Non-Religious in the Concepts of Creation and a Creator

Summary. One group of material factual issues about the nonreligious nature of creation-science involves its concept of creation and its indirect relation to concepts of a creator. The occurrence of creation is an aspect of creation-science, but it is important to note that this concept is not necessarily religious and is in fact derived from empirical evidence and scientific interpretations such as the abrupt

*Note: Philosophers and theologians cited in this Section b, unless otherwise indicated, are not creationists, and their quoted statements are not intended as endorse ments of creation-science. However, their quoted statements are acknowledging data that creationist philosophers and theologians interpret as supporting the equally nonreligious nature of creation-science and evolution.

appearance of complex life in the fossil record, as discussed in Section (1) below. By contrast, the concept of a creator is not central to creation-science, because while empirical scientific evidence can point to an abrupt appearance of the universe, life , and organisms, that evidence does not give direct information about the source or cause of creation. Hence, the concept of a creator is not central to creation-science, but instead steps outside the realm of science into philosophy, metaphysics, or theology, as discussed in Section (2) below. A public school teacher in presenting creation-science would not need to refer to a creator in the classroom any more than is currently needed in presenting evolution (and certainly need not discuss characteristics of the creator). (However, the federal courts have unanimously and frequently held that mention of a creator

in public schools does not violate the establishment clause.989/) This nonscientific inference of the existence of a creator is not necessarily religious but instead may be philosophical or metaphysical, and in fact has been in the history of thought, as discussed in Section (3) below. The concepts of creation and of a creator play a parallel nonreligious role in evolution and in creation-science, as discussed in Section (4) below. Important world views are consistent with evolution (materialism, naturalism, and positivism) and with creation-science (theism, deism, and metaphysical dualism), and the existence of God is ruled out by evolution in the view of a large number of evolutionists, as discussed in Section (5). These are material factual issues.

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989. Part B, Section 2[a](1) infra.

(1) Non-Religious Nature of Empirical Scientific Evidence Supporting Creation

Overview. The concept of creation is not inherently religious but is instead a proper scientific conclusion from the empirical scientific evidence supporting creation-science, such as the abrupt appearance of complex life in the fossil record. This same argument was made by Hoyle (then an Atheist) in defense of the "continuous creation hypothesis" of the 1940s, 1950s and 1960s:

> Some people have argued that continuous creation introduces a new assumption into science--and a very startling assumption at that. Now I do not agree that continuous creation is an additional assumption. It is certainly a new hypothesis, but it only replaces a hypothesis that lies concealed in the older theories, which assume, as I have said before, that the whole of the matter in the Universe was created in one big bang at a particular time in the remote past. On scientific grounds this big bang assumption is much the less palatable of the two. For it is an irrational process that cannot be described in scientific terms. Contin-

> uous creation, on the other hand, can be represented by mathematical equations whose consequences can be worked out and compared with observation.990/

The nonreligious and scientific meaning of "creation" is noted by Tax*:

> Here, there is ambiguity as to the meaning of the term creation. That this could imply for some people a natural process and for others a Creator is evident.
>
> . . ..
>
> Both a believing theist and a believing atheist can give their respective meanings to the word creation and accept it as occurring so early in time that everything else that exists in the universe has had ample time to develop "naturally."991/

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990. F. Hoyle, The Nature of the Universe 124 (1950). Lipson* (an Agnostic) makes a similar argument:

> I think, however, that we must go further than this and admit that the only acceptable explanation is creation. I know that this is anathema to physicists, as indeed it is to me, but we must not reject a theory that we do not like if the experimental evidence supports it.

Lipson*, A Physicist Looks at Evolution, 31 Physics Bulletin 138, 138 (1980).

991. Tax*, Reconciling Evolution and Creation, Free Inquiry, Jan.-Feb. 1983, at 37.

The affirmative scientific evidence supporting biological creation , biochemical creation, and cosmic creation that is discussed above992/ supports the occurrence or occurrences of creation independent of any religious considerations.

The following Sections discuss the:

(a)	Nonreligious use of "creation" in philosophy and history,
(b)	Scientific use of "creation" in the big bang hypothesis,
(c)	Scientific use of "creation" in the inflationary universe hypothesis,
(d)	Scientific use of "creation" in the continuous creation hypothesis,
(e)	Scientific use of "creation" in the directed panspermia hypothesis, and
(f)	Scientific use of "creation" in other hypotheses.

(a) Nonreligious Use of "Creation" in Philosophy and History. The concept of creation itself is not inherently religious,

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992. Sections 2[a](1), 2[b](1), and 2[c](1) supra.

such as the conclusion that an arrowhead, Stonehenge, or "creative art" was created.993/ The nonreligious use of "creation" is also evident and in fact "indispensable" in moral and aesthetic philosophy:

> "Creation," "creativity," and related concepts are indispensable in any adequate moral and aesthetic philosophy. In those contexts they are logically connected with the ideas of human freedom, moral vision, moral criticism, ideas of inventiveness, originality, and the life of imagination. Indeed, a significant part of the metaphysical

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993. Foster*, The Christian Doctrine of Creation and the Rise of Modern Natural Science, 43 Mind 446, 462 (1934) ("This may be most easily seen in the contrast of fine or creative art with the activity of a Demiurge or artificer. It is notorious that the creative artist, e.g., the painter, has no clear knowledge of what he is going to achieve before he has achieved it; and the critic on his side, when confronted with a work of creative art, is indeed aware that there is 'something more' in it than the sensible material--a great painting is more than a certain complexity of coloured surfaces--but this 'something more' (we may call it loosely 'the meaning') is not capable of being conceived in distinction from the sensible material in which it is expressed.").

> and theological discussion of creation can be translated or "demythologized" into moral and aesthetic terms, and it has been indirectly relevant to the development of moral philosophy and aesthetic theory.994/

Plato posited a Demiurge who non-naturalistically operated on existing matter and forms but who lacked the supernatural characteristics of the omnipotent God of Genesis, which is an important part of the history of philosophy.995/ Leslie* and some other modern philosophers argue for the "creative ethical requiredness" of the universe "independent of Theistic religion":

> (a) Belief in the universe's creative ethical requiredness can exist independently of any centuries-old association with Christianity. So it need not share what you or I may think of as Christianity's implausibility, conflict with scientific findings, moral defects, etc.

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994. Hepburn*, Creation, Religious Doctrine of: Creation in the Context of Scientific Cosmological Theories, 2 Encyclopedia of Philosophy 255, 256 (P. Edwards ed. 1967).

995. Plato, Timaeus bk. _____.

> (b) . . . Above all no recourse need be had to any inexplicably existing Divine Person endowed with a desire to produce good.996/

While the concept of creation concededly has a non-naturalistic aspect (as evolution does) it is not necessarily supernatural, as these examples show, because empirical scientific evidence pointing to creation cannot indicate whether the source of creation was a non-naturalistic force or process or a supernatural deity (as discussed later997/).

(b) Scientific Use of "Creation" in Big Bang Hypothesis. The scientific and nonreligious nature of the concept of creation can be seen in the frequent use of that term to mean "abrupt appearance" by

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996. Leslie*, Cosmology, Probability, and the Need To Explain Life, in Scientific Explanation and Understanding 53, 56 (N. Rescher ed. 1983).

997. Section 3[b](3) infra.

scientists other than creationist scientists. For example, the "big bang theory requires a recent origin of the Universe that openly invites the concept of creation."998/ The following standard scientific books about the big bang hypothesis have used the term "creation" in a totally scientific sense to mean "abrupt appearance":

George Gamow*, The Creation of the Universe (1955)
John D. Barrow* & Joseph Silk*, The Left Hand of Creation: The Origin and Evolution of the Expanding Universe (1983)
James S. Trefil*, The Moment of Creation: Big Bang Physics Before the First Millisecond to the Present Universe (1983)
Albert C. Choate*, The Core of Creation: An Investigation into the Fundamentals of Reality and the Foundations of Existence (1982)
Joseph Silk*, The Big Bang: The Creation and Evolution of the Universe (1980)999/

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998. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 237 (1983).

999. Accord, Wilczek*, The Cosmic Asymmetry between Matter and Antimatter,

In fact, Gamow*, who described the big bang as "the creation of the universe," actually formulated the modern version of that hypothesis.1000/ Sagan* and many others have referred to the big bang as a "creation" in the sense of an abrupt appearance.1001/

Scientific American, Dec. 1980, at 82, 83 ("creation"); Wynn-Williams*, The Newest Stars in Orion, Scientific American, Aug. 1981, at 46, 65 ("creation"); Trefil*, Closing in on Creation, Smithsonian, May 1983, at 33, __("creation"); Trefil*, Matter vs. Antimatter, Science 81, Sept. 1981, at 66, 66-67 ("creation"); Sandage*, Time Scale of Creation, in Galaxies and the Universe 75 (L. Woltjer ed. 1968) ("creation").

1000. G. Gamow*, The Creation of the Universe 20 passim (1955).

1001. C. Sagan*, Cosmos 259 (1980)("In one, the universe is created, somehow, ten or twenty billion years ago and expands forever, the galaxies mutually receding until the last one disappears over our cosmic horizon. . . . In the other, the oscillating universe, the Cosmos has no beginning and no end, and we are in the midst of an infinite cycle . . .."); J. Silk*, The Big Bang 144 (1979) ("the singularity, when creation of matter possibly occurred"); Trefil*, Matter vs. Antimatter, Science 81, Sept. 1981, at 66, 66-67 ("One argument is that more matter than antimatter was created during the Big Bang, the cataclysmic ex-

(c) Scientific use of "Creation" in Inflationary Universe Hypothesis. The term "creation ex nihilo" (creation from nothing) is used to describe the recent inflationary universe hypothesis, as Guth* of MIT writes:

> Recently there has been some serious speculation that the actual creation of the universe is describable by physical laws. In this view the universe would originate as a quantum fluctuation, starting from absolutely nothing. The idea was first proposed by Edward P. Tryon of Hunter College of the City University of New York in 1973, and it was put forward again in the context of the inflationary model by Alexander Vilenkin of Tufts University in 1982.1002/

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plosion that marked the beginning of the universe."); Davies*, Chance or choice: is the Universe an accident?, _____ New Scientist 506, 507 (1978)("Modern cosmology also has a version of the creation--a hot big bang, which occurred about 15 billion years ago."); Waldrop*, Before the Beginning, Science 84, Jan-Feb. 1984, at 45, 46, 47 ("Except for a few educated guesses, no one has the slightest idea what went on in that first instant of creation.").

1002. Guth* & Steinhardt*, The Inflationary Universe, Scientific American, May 1984, at 116, 128. Accord, H. Bondi*, Cosmology 144 (1968) ("It should be clearly

Tryon* uses the same terminology:

> In 1973, I proposed that our Universe had been created spontaneously from nothing (ex nihilo), as a result of established principles of physics. This proposal variously struck people as preposterous, enchanting, or both.
>
> The novelty of a scientific theory of creation ex nihilo is readily apparent, for science has long taught us that one cannot make something from nothing. . . .
>
> . . ..
>
> Thus, the proposal of creation ex nihilo, originally motivated by a simple Newtonian estimate for gravitational energy and by the principles of quantum field theory, remains speculative, but appears viable in rather striking detail.1003/

This too points to the nonreligious nature of the concepts of "creation" and "ex nihilo."

(d) Scientific use of "Creation" in Continuous Creation Hypothesis. The continuous creation hypothesis, or steady state

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understood that the creation here discussed is the formation of matter not out of radiation but out of nothing."

1003. Tryon*, What Made the World?, New Scientist, Mar. 8, 1984, at 14, 16.

hypothesis, was formulated by Bondi*, Hoyle, and Gold*, and was the major challenge to the big bang hypothesis in the 1940s, 1950s, and 1960s. It was described as follows by Bondi* (of University of London):

> There is only one way in which a constant density can be compatible with a motion of expansion, and that is by the continual creation of matter. Only if the diminution of density due to the drift to infinity is counteracted by a constant replenishment of newly created matter can an expanding universe preserve an unchanging aspect.
>
> There is little doubt that the continual creation of matter necessary in this theory is the most revolutionary change proposed by it. There is, however, no observational evidence whatever contradicting continual creation at the rate demanded by the perfect cosmological principle.
>
> . . ..
>
> It should be clearly understood that the creation here discussed is the formation of matter not out of radiation but out of nothing.1004/

A similar view was expressed by Hoyle (of Cambridge).1005/ This hypothesis involved

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1004. H. Bondi*, Cosmology 143-44 (1968).

a "creation" in which "theistic implications are again eliminated."1006/

(e) Scientific Use of "Creation" in Directed Panspermia Hypothesis. The following scientists have similarly used the term "creation" in a scientific and non-religious sense in describing the directed panspermia hypothesis (life originating from outer space):

> Sir Fred Hoyle & N. Chandra Wickramasinghe, Evolution from Space: A Theory of Cosmic Creationism (1984)

1005. F. Hoyle, The Nature of the Universe 122-23 (1950) ("For I find myself forced to assume that the nature of the Universe requires continuous creation--the perpetual bringing into being of new background material."); F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 171 (1983) ("In 1948 I was criticised for proposing a theory in which matter could be created, but it is interesting to note that today many physicists find the notion quite acceptable.").

1006. Hepburn*, Creation, Religious Doctrine of: Creation in the Context of Scientific Cosmological Theories, 2 Encyclopedia of Philosophy 255, 256 (P. Edwards ed. 1967).

Sir Fred Hoyle, The Intelligent Universe: A New View of Creation and Evolution (1983)
Sir Francis Crick*, Life Itself: Its Origin and Nature (1981)

For example, directed panspermia is described as follows by Hoyle, an eminent British astronomer (and a former Atheist):

> This it seems to me explains why another intelligence, an intelligence which preceded us, was led to put together, as a deliberate act of creation, a structure for carbon-based life.
>
> . . ..
>
> The intelligence responsible for the creation of carbon-based life in the cosmic theory is firmly within the Universe and is subservient to it. Because the creator of carbon-based life was not all-powerful, there is consequently no paradox in the fact that terrestrial life is far from ideal.1007/

It is also advocated by Sir Francis Crick*, a Nobel Prize recipient as co-discoverer of the DNA structure, and N. Chandra Wickramasinghe (a Hindu and formerly a Nontheist),

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1007. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 226, 236 (1983).

who is chairman of applied mathematics and astronomy at University College in Cardiff.1008/

(f) Scientific Conclusions of "Creation" in Other Hypotheses. Other scientists have been forced by scientific evidence to mention and even accept creation, in the

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1008. Wickramasinghe is described as follows:

> Raised a Hindu in Ceylon (now Sri Lanka), he says he doesn't even share the basic premise of the Christian faith, much less the Christian fundamentalists' trust in the general 'inerrancy of the Bible in its original autographs.' And the book of Genesis couldn't be farther . . . .. 'Some 2,000 or so enzymes are known to be crucial [for] life--ranging from simple microorganisms all the way up to man. . . . [T]he probability of discovering this set by random shuffling is one in $10^{40,000}$, 'a number that 'exceeds by many powers of 10 the number of all atoms in the entire observable universe.'
>
> . . ..
>
> 'But the general concept of creation, that could be separated from the theological arguments, was one that I felt some intellectual sympathy for.'

Raloff*, They Call It Creation Science, Science News, Jan. 16, 1982, at 44, 46.

sense of an abrupt appearance of the first life or of organisms. A recent example is Ambrose*, emeritus professor of cell biology at University of London, who finds that information content and probability considerations compel the conclusion of "creative intelligence":

> We conclude therefore that recent hypotheses about the origin of species fall to the ground, unless it is accepted that an intensive input of new information is introduced at the time of isolation of the new breeding pair. This can be explained in terms of the operation of creative intelligence.
>
> . . . .
>
> It looks as though the advances in molecular, cellular, and developmental biology, which have been made in recent years and are summarised in this book, have brought us to the stage where a creative view of the origin of life and species no longer needs to be defended against evolutionary arguments.1009/

1009. E. Ambrose*, The Nature and Origin of the Biological World 143 (1982). Another example is Weisskopf*, who remarks that the universe "looks as if 'somebody' has arranged it so that the density is the same all over." Weisskopf*, The Origin of the Universe, 71 American Scientist 473, 478 (1983).

Lipson*, although an Agnostic, is forced by the "experimental evidence" to conclude "that the only acceptable explanation is creation."1010/ Similar conclusions can be found in the "secular creationism" of Professor D. N. Heribert-Nilsson (who firmly rejected the Genesis account of creation), a professor of botany and director of the Botanical Institute at Lund, Sweden.1011/ Creationist conclusions were also reached by

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1010. Lipson*, A Physicist Looks at Evolution, 31 Physics Bulletin 138, 138 (1980).

1011. Gray*, Alternative in Science: The Secular Creationism of Heribert-Nilsson, Origins, Summer 1982, at 8, 8, 13-14. Heribert-Nilsson wrote about "suddenly appearing . . . higher and lower forms":

> Instead they consist in each period of well distinguished groups of biota, suddenly appearing at a given time, always including higher and lower forms, always with a complete variability. At a certain time the whole of such a group of biota is destroyed. There are no bridges between these groups of biota following one upon the other.

Heribert-Nilsson, Synthetische Artbildung (1953) (page 1211 in English translation.)

Professor Louis Agassiz of Harvard, "America's leading biologist" at the time of Darwin,1012/ who was a Unitarian and rejected the Genesis account of creation.1013/ All of these scientists were driven to the conclusion of creation by scientific data totally independent of religious considerations (and in fact they rejected Genesis).

Summary. Thus, the term "creation," both as a philosophical matter and in scientific usage, is nonreligious and can be

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1012. Gould*, Catastrophes and Steady State Earth, Natural History, Feb. 1975, at 15, 15-16.

1013. J. Moore*, The Post-Darwinian Controversies 207, 208-09 (1979). Agassiz's biographer wrote:

> [T]he scientific study of nature . . . supplied the materials for an idealistic world view that transcended mere recorded assumptions about the powers of the Deity. The essence of the Creative Power was to be discovered in the book of nature itself, not in the Bible.

E. Lurie*, Louis Agassiz: A Life in Science 100 (1960). Accord, J. Teller*, Louis Agassiz, Scientist and Teacher 262 (1947).

scientific in meaning an abrupt appearance. It so appears in the writings of leading proponents of the big bang, inflationary universe, and continuous creation hypotheses about the origin of the universe, in the writings of directed panspermia advocates about the origin of the first life, and in the writings of others about the origin of organisms.1014/ This is a material factual issue.

(2) Noncentrality of a Creator to Creation-Science when Properly Defined

Overview. The concept of a creator is not an inherent part of presenting creation-science, and is certainly not central to creation-science.

1014. Provine*, Influence of Darwin's Ideas on the Study of Evolution, 32 BioScience 501, 502 (1982) ("Darwin, despite his detailed analogy of natural selection with artificial selection, had not one example of the new creation of a species by artifi-

(a) Creator Not Part of Creation-Science. The concept of a creator is not an inherent part of presenting creation-science simply because creation-science consists of empirical evidences and scientific interpretations that point to creation. The further inferences about the source or cause of creation (such as a creator, a force, or a process) move outside of the realm of science into the realm of philosophy, metaphysics, or theology. This distinction is made by Etkin, former professor of biology at Columbia, Chicago, CUNY, and Yeshiva University:

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cial selection through the whole history of mankind."); S. Løvtrup*, The Phylogeny of Vertebrata 25, 27 (1977) (species or terminal taxa are not fully definable because they "have not yet 'come into existence'" or are still "under creation."); F. Ayala* & J. Valentine*, Evolving: The Theory and Processes of Organic Evolution 340 (1979) ("The creation and concentration of active molecules could not lead to living organisms").

> Of course in invoking creation, science does not distinguish as to whether the creation is the act of a purposeful creator or a mere random accident. It merely asserts that the study of mechanisms has run into a dead end in which the non-mechanistic notion of creation must be invoked. Science by its nature cannot study the character of a creation. For the business of natural science is the interpretation of evidence in terms of mechanistic cause and effect. Where the evidence leads to the concept of creation science may follow. But where the evidence stops it must stop. Science can accept the concept of creation, as evidenced by the fact that it does so accept it today. Whatever scientific theory may become dominant in the future is not important. What is important is that scientific theory has been unfrozen. It is not committed in advance to complete determinism. It can use both the concept of mechanism and also that of creation.1017/

The detachment of the concept of creation from the concept of a creator is also evident in the scientists who have concluded from scientific evidence that an event or

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1017. Etkin, Science and Creation, in Challence: Torah Views on Science and Its Problems 241, 250-51 (rev. ed. 1978) (creationist scientist).

events of creation occurred but that a creator does not exist, such as Jastrow* (an Agnostic),1018/ Lipson* (also an Agnostic),1019/ and Bondi*, Gold* and Hoyle in the recent continuous creation hypothesis.1021/ In any event, a public school teacher in covering creation-science would not need to refer to a creator any more than is currently needed in presenting evolution (and certainly would not need to discuss various religious viewpoints about a creator).

(b) Creator Not Central to Creation-Science. Further, the concept of a creator is not central to creation-science in any event, because the empirical evidence involves indications of an occurrence or occurrences of creation and not of the source

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1018. R. Jastrow*, God and the Astronomers 11-12 (1978).

1019. Lipson*, A Physicist Looks at Evolution, 31 Physics Bulletin 138, 138 (1980).

or cause of those occurrences. Just as evolution often cannot resolve the question of who or what originated matter and energy in the cosmos and what mechanism brought about macroevolution (as discussed earlier),1022/ creation-science does not properly address the question of the source or cause of creation. The noncentrality of a creator to creation-science is evident in the absence of a creator from definitions of "creation" given by several public school textbooks produced by secular national publishers such as the following definition:

> Besides theories of change, some people believe that the many different kinds of organisms are a result of a special creation. These people believe that each organism was created separately. The organisms did not change in form. Instead, they were created as they appear now.1023/

1021. Section 3[b](1)(d) supra.
1022. Section 2[e](1)(a) supra.
1023. V. Webster* et al., Life Science 41-42; R. Hegner* & K. Stiles*, College

Mention of "creation" does not require discussion about a creator any more than mention of "creatures" in many evolutionist textbooks and other publications requires discussion about a creator.1024/

Zoology 790 (6th ed. 1959); "The doctrine of special creation, that is that each species of animal was specially created, is sufficiently refuted to the satisfaction of most biologists by the facts of organic evolution." Accord, G. Moment*, General Biology 563 (1950)("One of the oldest ideas and, until recently, the most widely accepted, is the theory of special creation. Certainly very few, perhaps no, biologists now believe that exercised creative powers over existing matter and forms, yet who each species was separately created and has existed since the beginning of the world."); P. Weatherwax*, Plant Biology 356 (1942) ("According to the various theories of special creation, every species of plant or animal was specially created long ago, when life was first placed on earth, and each species has continued unchanged to the present time."); Jennings*, _____, in Creation by Evolution 32, __ (F. Mason ed. 1928) ("One holds that the constitution of organisms is permanent; that they were created as they are and do not change. . . . The facts observed are what the doctrine of evolution demands, not what the opposite theory demands.").

1024. E.g., Oxnard*, Human Fossils:

Summary. Thus, the concept of a creator is not an inherent part of presenting, and is certainly not central to, creation-science. This is a material factual issue.

(3) Non-Religious Nature of the Inference of a Creator from Scientific Evidence

Overview. The concept of a creator is not necessarily supernatural and not necessarily religious, and an inference of the existence of a creator from the scientific evidence supporting creation is nonreligious (although that inference is also nonscientific). The following Sections discuss:

(a)	Nonsupernatural concepts of a creator,
(b)	Academic secular discussion of a creator, and
(c)	Clear constitutionality of reference to a creator.

New Views of Old Bones, 41 American Biology Teacher 264, 264 (1979) ("a creature such as Zinjanthropus").

(a) Nonsupernatural Concepts of a Creator. Many individuals in the history of philosophy have made a nonreligious inference of the existence of a creator from secular observations or thoughts. Plato described a Demiurge who intervened in nature and was not supernatural in the sense of Genesis.1025/ The modern day advocates of the directed panspermia hypothesis similarly make a scientific inference of the existence of a creator ("intelligence") of information content who is very different from the creator of Genesis:

> It is far less difficult to grapple with the issues in a future-to-past sense, because then we approach the ultimate cause instead of receding from it, the ultimate cause being a source of information, an intelligence if you like, placed in the remote future.1026/

1025. Plato, Timaeus bk. _____.

1026. F. Hoyle, The Intelligent Universe: A New View of Creation and Evolution 189, 214 (1983). Accord, F. Hoyle & N. Wickramasinghe, Evolution from Space 150

Biologist Ambrose* concludes that the vast information content in living organisms could only arise from "Creative Intelligence," which is also a nonpersonal nonbiblical creator:

> Having our factor X as input of new information into a biological system, which is essential at each level of increased complexity in the biological world, we are in a position to examine in more detail how this new information

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(1981) ("From the beginning of this book we have emphasized the enormous information content of even the simplest living systems. The information cannot in our view be generated by what are often called 'natural' processes, as for instance through meteorological and chemical processes occurring at the surface of a lifeless planet. As well as a suitable physical and chemical environment, a large initial store of information was also needed. We have argued that the requisite information came from an 'intelligence', the beckoning spectre.

To be sure, the books in the library contain information. Yet we do not think of a book as an 'intelligence'. A further quality is needed to define intelligence, namely the ability to act on information which a book alone cannot do. As well as providing information, our spectre is required also to act on it, which is why we refer to the thing as an 'intelligence'.").

> could arise. . . . I now suggest that our factor X, being an input of new information, requires the operation of Creative Intelligence, and I hope to show that the operation of creative intelligence leads to a minimum number of universals to explain both the origin and basic nature of living organisms.1027/

Many Agnostics recognize the possibility of an unorthodox "watchmaker" for the universe as a nonreligious matter of causal reasoning, such as Macbeth* (a "skeptic")1028/ and Einstein, who was driven to say "I cannot believe that God plays dice with the cosmos."1029/ Similarly, Wickramasinghe was compelled by information content considerations to reject his "'philosophical preference' . . . to have life form in the cosmos by random shuffling," and to acknowledge the existence of a nonpersonal "crea-

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1027. E. Ambrose*, The Nature and Origin of the Biological World 140-44, 164 (1982)

1028. N. Macbeth*, Darwin Retried ___ (1971).

tor," while rejecting Genesis and "'inerrancy of the Bible.'"1030/

Other nonsupernatural concepts of a creator can be seen in Gould's* statement that "[n]atural selection is a creator; it builds adaptation step by step,"1031/ and Foster's* description of a "Demiurge or artificer" as creator of "creative art."1032/

In parallel, a sizable minority of evolutionists draws a nonscientific inference of the nonexistence of a creator from the scientific evidence on origins as the next Section discusses. Just as evolution does not become religious because of these inferences of the nonexistence of a creator,

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1029. London Observer, Apr. 5, 1964, § ___, at _____.

1030. Raloff*, They Call It Creation Science, Science News, Jan. 16, 1982, at 44, 46.

1031. Gould*, Darwinism and the Expansion of Evolutionary Theory, 216 Science 380, 381 (1982).

1032. Foster, The Christian Doctrine of Creation and the Rise of Modern Natural Science, 43 Mind 446, 462 (1934).

creation-science does not become religious because of inferences of the existence of a creator.

(b) Academic Secular Discussion about a Creator. The nonreligious nature of the concept of a creator is evident in the detached academic discussion of the creator within philosophy, within metaphysics, within history, and within literature. Philosophic consideration of a creator includes the nonreligious arguments of William James and other philosophers, as well as the argument for a "creative force" by Leslie*, which "does not always indicate belief in a Designer" and "can be defended independently of any religion."1033/ Similarly, Artistotle used secular causal reasoning to derive the existence of a "First Unmoved Mover" who

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1033. Leslie*, Anthropic Principle, World Ensemble, Design, 19 American Philosophical Ouarterly 141, 141 (1982).

was not "an object of worship" (and did not actually exercise creative powers).1034/ Historical discussion of the creator includes discussing beliefs of historical leaders such as George Washington, Abraham Lincoln, and Stonewall Jackson, who had and expressed very strong religious beliefs; and in discussing historical documents such as the Mayflower Compact and the Declaration of Independence. The Declaration of Independence refers to "the Creator" in four places such as the following:

> When in the Course of human events, it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume among the powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation. We hold these truths to be self-evident, that all

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1034. F. Copleston*, A History of Philosophy 317 (1946), Accord, Aristotle, Metaphysics bk. Lambda.

> men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness. . . . 1035/

Literary consideration of a creator includes study of "the Bible . . . for its literary and historical qualities," as well as of "comparative religion or the history of religion," under the Supreme Court's decision on public school Bible reading.1036/ Other literary study includes the divine judgment themes of Dante's Divine Comedy, the light and dark themes of Melville's Billy Budd, and other literary works. All of these secular discussions about a creator are non-religious.

1035. Declaration of Independence (1776).

1036. Abington School District v. Schempp, 374 U.S. 203, 225 (1963). Accord, Epperson v. Arkansas, 393 U.S. 97 106 (1968).

(c) Clear Constitutionality of Reference to a Creator. Federal and state courts unanimously have upheld public school reference to a creator (or to God) as constitutional under the establishment clause.1037/ For example, the U. S. Supreme Court stated in the very decision overturning public school prayer:

> There is of course nothing in the decision reached here that is inconsistent with the fact that school children and others are officially encouraged to express love for our country by reciting historical documents such as the Declaration of Independence which contain references to the Deity or by singing officially espoused anthems which include the composer's professions of faith in a Supreme Being, or with the fact that there are many manifestations in our public life of belief in God. Such patriotic or ceremonial occasions bear no true resemblance to the unquestioned religious exercise [prayer] that the State of New York has sponsored in this instance.1038/

The Supreme Court has emphasized that our

1037. Part B, Section 2[a](1) infra.

1038. Engel v. Vitale, 370 U.S. 421, 435 n. 21 (1962).

"institutions presuppose a Supreme Being,"1039/ and similarly stated this year:

> Our history is replete with official references to the value and invocation of Divine guidance in deliberations and pronouncements of the Founding Fathers and contemporary leaders. . . .
>
> . . . .
>
> Other examples of reference to our religious heritage are found in the statutorily prescribed national motto "In God We Trust," 36 U.S.C. §186, which Congress and the President mandated for our currency, see 31 U.S.C. §324, and in the language "One nation under God," as part of the Pledge of Allegiance to the American flag. That pledge is recited by thousands of public school children--and adults--every year.1040/

Courts have unanimously upheld the daily pledge to the flag in public schools that refers to one nation "under God."1041/ They have sustained the national motto, "In God We Trust," and the national anthem,

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1039. Lynch v. Donnelly, _____ U.S. ____, 104 S.Ct. 1355, ___ (1984); Zorach v. Clauson, 343 U.S. 306, 313 (1952).

1040. Lynch v. Donnelly, ____ U.S. at ____, 104 S.Ct. at ___.

1041. Note 1558 infra.

sung in public school assemblies, that contains the phrase "in God is our trust."1042/ The Supreme Court recently upheld legislative prayers to God.1043/ Presidents have traditionally issued Thanksgiving and prayer proclamations to God, and Congress and the courts have traditionally begun sessions with prayer to God.1044/ All of these governmental references to a creator or to God have been upheld as constitutional, as discussed later. Thus, public school mention of a creator, regardless of whether or not the concept is inherently religious, does not violate the establishment clause.

Summary. Thus, the concept of a creator is not necessarily religious, and may instead be philosophical or metaphysical.

1042. Note 1557 infra.

1043. Marsh v. Chambers, ___ U.S. ___ (1983). Accord, Lynch v. Donnelly, ___ U.S. at ___, 104 S. Ct. at ___.

1044. Lynch v. Donnelly, ____ U.S. at ___, 104 S. Ct. at ____, note ____ infra.

In any event, it does not bring violation of the establishment clause. This is a material factual issue.

(4) Parallel Non-Religious Relation to a Creator and Creation of Evolution and Creation-Science

Overview. Evolution and creation-science are exactly parallel in their implications about a creator. This can be seen in several areas:

(a) Evolutionist inferences about the existence of a creator, (b) Evolutionist allegations of no scientific implication for religion, (c) Evolutionist references in science publications to a creator, and (d) Basis of modern science in belief in a creator.

(a) Evolutionist Inferences about the Existence of a Creator. A sizable minority of evolutionist scientists draw the inference of the nonexistence of a creator from the scientific data on origins. The McLean

decision denied this:

> Evolution does not presuppose the absence of a creator or God and the plain inference conveyed by Section 4 is erroneous.1047/

However, evolutionists do make inferences about a creator, and at least a sizable minority of evolutionist scientists infers that "[t]here are no gods" and that science and religion are not "compatible":

> Evolutionists still disagree about the precise mechanisms of evolution in nature, but they have nevertheless given overwhelminc support to Darwin's belief that design in nature results from purely mechanistic causes. . . .
>
> Here are the implications of this mechanistic view of life as I see them. First, except for purely mechanistic ones, no organizing or purposive principles exist in the world. There are no gods and no designing forces. The frequently made assertion that modern biology and the assumptions of the Judeo-Christian tradition are fully compatible is false.1048/

1047. McLean v. Arkansas Board of Education, 519 F. Supp. 1255, 1266 (E.D. Ark. 1982).

1048. Provine*, Implications of Darwin's Ideas on the Study of Evolution, 32

Many evolutionist scientists have published similar conclusions,1049/ as well as many

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BioScience 501, 506 (1982) (Professor of history at Cornell, co-author of The Evolutionary Synthesis).

1049. Mayr*, The Nature of the Darwinian Revolution, 176 Science 981, 988 (1972) ("The natural causes postulated by the evolutionists completely separated God from his creation, for all practical purposes. The new explanatory model replaced planned teleology by the haphazard process of natural selection."); Mayr*, Foreward to M. Ruse*, Darwinism Defended, at xi-xii (1982) ("This theory [natural selection] is so important for the Darwinian because it permits the explanation of adaptation, the 'design' of the natural theologian, by natural means, instead of divine intervention."); Dawkins*, Universal Darwinism, in Evolution from Molecules to Men 403, 417 (D. Bendall ed. 1983)("'The greatest concession they could make to Darwin was that the Designer operated by tinkering with the generation of diversity, designing the variation'. Darwin's response was: 'If I were convinced that I required such additions to the theory of natural selection, I would reject it as rubbish . . . . I would give nothing for the theory of Natural Selection, if it requires miraculous additions at any one stage of descent.'") Ghiselin*, Darwin and Evolutionary Psychology 964, 967 (1973) ("The Darwinian solution was to view evolution as a change in developmental mechanisms, with natural selection (and other mechanisms of adaptation) disposing of any need to invoke supernatural agencies.").

evolutionist philosophers and historians.1050/

1050. D. Nelkin*, Science Textbook Controversies and the Politics of Equal Time 11 (1977) ("Beyond its impact on traditional science, Darwinism was devastating to conventional theology."); J. Barzun*, Darwin, Marx, Wagner 10-11 (2d ed 1958)("The entire phrase and not merely the words Natural Selection is important, for the denial of purpose in the universe is carried in the second half of the formula--accidental variation. This denial of purpose is Darwin's distinctive contention. . . . In this way the notion of a Deity or Providence or Life Force having a tendency of its own, or even of a single individual having a purpose other than survival or reproduction, was ruled out."); Grene*, The Faith of Darwinism, Encounter, Nov. 1959, at 48, 48 ("'. . . Darwin has demonstrated this force, this process of Nature; he has opened the door by which a happier coming race will cast out miracles, never to re-return. Everyone who knows what miracles imply will praise him, in consequence, as one of the greatest benefactors of the human race.'

Thus wrote the Biblical critic David Strauss in The Old Faith and the New, published in English translation in 1873 . . . ."); K. Cauthen*, The Impact of American Religious Liberalism 22 (1962)("Darwin in 1859 propounded the theory of organic evolution with reference to the biological world. These theories completely ruled out the traditional notion that God had created the world and its inhabitants in their present form by divine fiat at definite moments

"It is no coincidence that almost all the early proponents of Darwinism were atheistic materialists--or their near relatives," according to philosopher Hull*.1051/ Darwin* himself moved to "agnosticism tending at times toward atheism," as assessed by historian Moore* and others:

> [F]rom an early orthodoxy Darwin passed in middle life into a liberal form of theism, and thence, in his last decades, into an acnosticism tending at times towards atheism.
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> . . ..
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> All he could believe in was 'my deity, "Natural Selection"'.1052/

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of time."); T. Roszak*, Unfinished Animal, 102 (1975) ("The irony is devastating. The main purpose of Darwinism was to drive every last trace of an incredible God from biology. But the theory replaced the old God with an even more incredible deity--omnipotent chance."); see also Goldman*, A Criticial Review of Evolution, in Challenge: Torah Views on Science and Its Problems 216, 218 (rev. ed. 1978) ("God is irrelevant in the Darwinian evolutionary scheme, and that is what is wrong with it for a Jew.").

1051. Hull*, _____, in The Comparative Reception of Darwinism 388, 391 (T. Glick ed. 1974).

1052. J. Moore*, The Post-Darwinian Controveries 109, 314-15, 344 (1979). Ac-

T. H. Huxley*, "Darwin's bulldog" and chief advocate, was an Agnostic and actually coined that term.1053/ Haeckel*, the formulator of the "biogenetic law" of embryological recapitulation and a leading Darwinian, was an Atheist who argued "no miracle,

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cord, Ghiselin*, Darwin and Evolutionary Psychology, 179 Science 964, 967 (1973)("He [Darwin] remarked that the theory of evolution 'would make a man a predestinarian of a new kind, because he would tend to be an atheist' (8, p. 74)."); Grene*, The Faith of Darwinism, Encounter, Nov. 1959, at 48, 48 (Darwin wrote in his autobiography: "I can indeed hardly s ee how anyone ought to wish Christianity to be true . . .."); G. Himmelfarb*, Darwin and the Darwiniam Revolution 81 (1962)(Darwin wrote that "'disbelief crept over me at a very slow rate, but was at last complete.'").

1053. T. Huxley*, Agnosticism and Christianity (1889); J. Barzun*, Darwin, Marx, Wacner 66, 67 (1958) ("I must again refer to Huxley, whose remark about 'the Hegira of Science from the idolatries of special creation ' and the 'purer faith of Evolution' was made, not in the enthusiam of 1859, but after fifteen years' reflection. Huxley could truthfully call himself an agnostic and a religious man at the same time, for he was completely devout about the new faith."); Hepburn*, Agnosticism, 1 Encyclopedia of Philosophy 56, 56-67 (P. Edwards ed. 1967).

no Creation, no Creator."1054/ Julian Huxley*, who devised the name of and co-formulated the neo-Darwinian "evolutionary synthesis," was also "an Atheist" and argued that in "the evolutionary pattern of thought there is no longer either need or room for the supernatural."1055/

Most of the ACLU witnesses in science and philosophy and history provide similar

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1054. Levinton*, Charles Darwin and Darwinism, 32 BioScience 495, 495 (1982). Accord, E. Haeckel*, The Riddle of the Universe 337 (1899)("With this single argument the mystery of the universe is explained, the deity annulled, and a new era of infinite knowledge ushered in."); id. at ___ ("the untenable myth of a 'wise Providence' and of an '"All-loving Father in heaven."'); E. Nordenskiold*, The History of Biology 506 (1935) ("with the hatred Haeckel felt for Christianity in later years.").

1055. Huxley*, The Evolutionary Vision in 3 Evolution after Darwin at 249, 252 (S. Tax & C. Callender eds. 1960). Accord, J. Huxley*, Religion without Revelation 58 (rev. ed. 1957) ("astronomy had no need for the god hypothesis: Darwin and Pasteur between them did the same for biology").

examples. Atheists include geologist Dalrymple*,1056/ historian McLoughlin*,1057/ and sociologist Nelkin*1058/ (a McLean witness), while Agnostics include astronomer Sagan*,1059/ paleontologist Gould*,1060/ philosopher Ruse*,1061/ and historian Numbers*.1062/ Many other leading evolutionists fall in the same category. Atheists include Simpson*,1064/ and Asimov* (who

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1056. Deposition of G. Brent Dalrymple* at ____, Keith v. Louisiana Department of Education, No. 81-989B (M.D. La., filed Dec. 2, 1981).

1057. Deposition of Willilam McLoughlin* at ___, id.

1058. Trial tr., vol. 2 at ___, McLean v. Arkansas Board of Education 529 F. Supp 1255 (E.D. Ark. 1982).

1059. Deposition of Carl Sagan* at ___ Keith v. Louisiana Department of Education, No. 81-989B (M.D. La., filed Dec. 2, 1981).

1060. Deposition of Stephen J. Gould* at ___, id.

1061. Deposition of Michael Ruse* at ___, id.

1062. Deposition of Ronald Numbers* at ___, id.

1064. G. Simpson*, This View of Life viii, 4, 12 (1964) ("the higher supersti-

signed Humanist Manifesto II saying that "[w]e find insufficient evidence for belief in the existence of a supernatural").1065/

On the other hand, a significant minority of evolutionist scientists draw the inference of the existence of a creator, in a theistic evolutionary viewpoint. For example, "Einstein use[d] his concept of God more often than a Catholic priest,"1066/ while Milne* concluded his treatise on relativity by saying: "As to the first cause of the Universe, in the context of expansion,

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tions celebrated weekly in every hamlet of the United States").

1065. Humanist Manifestos I & II at ___ (P. Kurtz ed. 1973). Others are astronomers Abell* and Pecker* and anthropologists Birx*, Tomashevich*, and Firth*, who signed the Secular Humanist Declaration, which endorses Atheism and evolution. Kurtz*, A Secular Humanist Declaration, Free Inquiry, Winter 1980-81, at 3, 7.

1066. Ferris*, The Other Einstein, Science 83, Oct. 1983, at 35, 38. Accord, n. 1029 supra.

that is left for the reader to insert, but our picture is incomplete without Him."1067/ Historically, Asa Gray* and Alfred Russell Wallace*1068/ as well as many Theological Liberals (dicussed later),1069/ were theistic evolutionists.

If evolution is not made religious by these evolutionist inferences about the nonexistence or existence of a creator, creation-science is similarly not made religious by creationist inferences about the existence of a creator. In either case, the inference is not part of the scientific explanation, but is an implication outside of the realm of science. Creation-science and evolution are parallel in inferences about a creator drawn by their proponents.

1067. R. Jastrow*, God and the Astronomers 112 (1978).
1068. J. Moore*, The Post-Darwinian Controversies ___(1979).
1069. Section 3[c](1)(a)(ii) infra.

(b) Evolutionist Allegations of No Scientific Implication for Religion. Some evolutionists try to deny the evolutionist implications about a creator by statements such as that "[r]eligion and science are separate and mutually exclusive realms of human thought . . .."1072/ That approach is repudiated by many leading evolutionists such as Provine* and Nelkin* and others:

> The recurrence of textbook disputes suggests that the truce between science and religion, based on the assumption that they deal with separate domains, may be a convenient but unrealistic myth. Religion as well as science purports to be a picture of reality, a means through which people render their lives and the world around them intelligible.1073/
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> [M]odern evolutionary biology instead of being fully compatible with Christianity . . . is actually deeply incompatible with fundamental assump-

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1072. Committee on Science and Creationism*, Science and Creationism 6 (1984).

1073. D. Nelkin*, Science Textbook Controversies and the Politics of Equal Time 11 (1977).

tions not only of Christianity but also of most other religions of the world.1074/

1074. Address of Dr. Wm. Provine* entitled "Theories of Creationism and Evolution from a Historical Perspective" before Sigma Xi Chapter at Corning, N.Y. (Nov. 17, 1981). Accord, Watkins*, Against 'Normal Science', in Criticism and the Growth of Knowledge ___, 36 (I. Lakatos & A. Musgrave eds. 1970) ("If someone holds that, say, Biblical myths and scientific theories are are incommensurable, belong to different universes of discourse, he presumably implies that the Genesis account of the Creation should not be regarded as logically incompatible with geology, Darwinism, etc.; they are compatible and can peacefully coexist just because they are incomensurable. But if the Ptolemaic system is logically incompatible with the Copernican system, or Newtonian theory with Relativity Theory, peaceful coexistence is not possible: they were rival alternatives; and it was possible to make a rational choice between them partly because it was possible to devise crucial experiments between them (stellar parallax, starshift, etc.)."); K. Pearson*, Grammar of Science 14, 24 (1911) ("The goal of science is clear--it is nothing short of the complete interpretation of the universe. Science does much more than demand that it shall be left in undisturbed possession of what the theologian and metaphysician please to call its 'legitimate field.' It claims that the whole range of phenomena, mental as well as physical--the entire universe--is its field. It asserts that the scien-

"The view that science is quasi-independent of such disciplines is itself a research tradition, one of relatively recent origins," and not shared by most philosophers of science.1075/ Indeed, that view of exclusive

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tific method is the sole gateway to the whole region of knowledge.").

A Roman Catholic theologian concurs: "That Revelation should be a 'religious doctrine' does not mean it contains no information touching the subject matter of science, unless it is assumed science alone can comprehend and convey understanding of the visible world. That, however, is precisely the point at issue, which cannot be decided primarily on scientific grounds, but on other: The Catholic on one set of beliefs, the secular humanist on another. The Church does not maintain Revelation is a scientific textbook such as to provide exact parallels for every scientific question. At certain points, however, science and Revelation meet, and at those points, e.g., the question of origins, Revelation undoubtedly has something to say basic to scientific understanding and science. P. Fehlner, In the Beginning 34 (unpub. ms. 1983).

1075. L. Laudan*, Progress and Its Problems 131 (197_) (emphasis deleted). Smart*, in the article on Religion and Sci-

realms is primarily the product of one par-

-ticular theological view: Neo-Orthodoxy.1076/

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ence in the Encyclopedia of Philosophy, also concurs with Provine* and Nelkin*:

> Separation of religion and science. If the foregoing arguments are correct, it would appear that there are important areas in which science and religion impinge on each other. Some of the battlefields are indeed now deserted, and many of the polemics of nineteenth century writers are no longer of interest. Nevertheless, it has been suggested in this article that in fundamental ways science does impinge on theology and that some of the conflicts between them are even sharper than they were a hundred years ago.

Smart*, Religion and Science, 7 Encyclopedia of Philosophy 158, 162 (P. Edwards ed. 1967).

1076. Cooray*, Letter, Geotimes, May 1984, at 7 ("Contemporary theology of the Neo-Orthodox movement, in line with most religious thinkers through the ages, stresses the specificity of Biblical language. Immanent meaning resides in the Word, which is both the occasion and content of Truth expressed. The Word is historical, directional, self-contained and self-referential. . . . Thus, religion and science use two coexistent, nonoverlapping language meaning structures, even when the words sound and are applied the same. Religion and science need not contradict one another, but can coexist without intruding on each other's

Thus, the argument that evolution cannot have implications about a creator, and that they are "mutually exclusive realms," is at best a minority theological-philosophical position and at worst incorrect.

(c) Evolutionist References in Science Publications to a Creator. Further, many evolutionist science publications actually do refer to a creator or to God. For example, Darwin's Origin of Species contains many references to a creator, and ends with a reference in the last paragraph to "the Creator."1077/ Many other evolutionist books on science refer to God or the Bible.1077a/

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realms;") see also R. Cross*, The Emergence of Liberal Catholicism in America 152-53, (1958)("Some of the liberals hoped to avoid the difficulties of concordism altogether by arguing that the Bible did not teach any scientific or historical truth 'as such.'").

1077. C. Darwin*, The Origin of Species: A Variorum Text 759 (M. Peckham ed. 1959). Accord, id. at 343, 753, 757-58, passim.

1077a. E.g., N. Eldredge*, The Monkey

One leading biology textbook for high schools, which has been adopted by the Louisiana Board of Elementary and Secondary Education and which is used in Louisiana high schools, quotes Darwin's reference to "the Creator," and quotes another scientist's reference to "'the Supreme and Omnipotent Creator'" and to "'kinds of plants and animals.'"1078/ Another Louisiana evolutionary textbook refers to "the flood recorded in Genesis of the Hebrew Bible."1079/ Other Louisiana texts encourage teachers to discuss the "Biblical account of special

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Business 7-9 (1982) (quoting Genesis 1); Weisskopf*, The Origin of the Universe, 71 American Scientist 473, 480 (1983) (comparing "the Judeo-Christian tradition" and "the Bible" to modern science as "surprisingly similar").

1078. Biological Science Curriculum Study*, Biological Science: Molecules to Man 100, 111 (3d ed. 1973 & 1976).

1079. Biological Science Curriculum Study*, Biological Science: An Ecological Approach 310 (3d ed. 1973 & 1976).

creation" and refer to God and endorse theistic evolution:

> This question could lead to a discussion of other theories of the origin of life and species. Several students might mention the Biblical account of special creation. Other students might mention other beliefs.1080/

1080. R. Oram*, Biology: Living Systems 265 (3d ed. Teacher's ed. 1979). This textbook also spells out a theistic evolutionary religious viewpoint with many references to God and the Bible, which some but not all evolutionist scientists and public school students and parents would find objectionable, in the teachers' edition:

> Many biologists, as well as theologians, believe in God, and many of them believe that He created the world. But they also believe that He gave living creatures the ability to adapt to changing environments--and that, because of this ability, living creatures have evolved and developed into today's species. . . . In other words, there is no necessary conflict between those who believe that God created all living things and those who believe that living things have evolved over time. One can believe in evolution (or not believe in it) regardless of one's religious beliefs. p. 732.
>
> There is nothing in the theory of evolution that is contrary to the religious beliefs of millions of people;

> Many theologians view evolution as 'God's plan' for the development of a new species.1081/

A college evolution text tells us that "the first chapters of Genesis are great religion. Why worry about the fact that they

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> and there is nothing in their religious beliefs that is necessarily contrary to the theory of evolution. . . .
>
> Some may say that the theory of evolution is in conflict with the biblical account of the creation of humans. Strictly speaking, that is not so. If one takes every statement in the Bible as being literally true, there will indeed be conflict. But one can accept the spirit of the biblical account, recognizing God as the Creator of humans, and still regard them as the product of eons of evolutionary development. In this view, the evolutionary development which ended in humans was set in motion by God Himself.

Id. at 732.

1081. C. Heimler*, Focus on Life Science 431 (Teacher's ed. 1981). Accord, S. Weinberg*, Biology: An inquiry into the Nature of Life 415 (4th ed. 1977) ("The hand of God is just as evident in evolution extending over billions of years as in creation occurring in an instant or a few days.")

are not valid science?"1082/ Many evolutionist scientists have written books discussing Genesis, theistic evolution, a "religion of Evolutionary Humanism," etc., as described later.1082a/ While such statements are not appropriate for either evolutionist or creationist textbooks in public schools, it is significant to note that evolutionist books extensively refer to a creator, to God, and to the Bible, just as some nonscientific creationist publications do.

(d) Basis of Modern Science in Belief in a Creator. Modern science "owes its very birth and life" to the once nearly

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1082. P. Moody*, Introduction to Evolution 513 (2d ed. 1962). Accord, W. Stansfield*, The Science of Evolution 578 (1977) ("Deity . . . create[d] gradually through an evolutionary process"); G. Van Wylen* and R. Sonntag*, Fundamentals of Classical Thermodynamics 243 (2d ed. 1970)("the prior and continuing work of a creator, who also holds the answer to the future destiny of man and the universe").

1082a. Section 3[c](1)(a) infra.

universal belief in a creator, according to Stanley Jaki*, the eminent Georgetown University philosopher and historian of science:

> Its thesis can easily be summed up. Great cultures, where the scientific enterprise came to a standstill, invariably failed to formulate the notion of physical law, or the law of nature. Theirs was a theology with no belief in a personal, rational, absolutely transcendent Lawgiver, or Creator. Their cosmology reflected a pantheistic and animistic view of nature caught in the treadmill of perennial, inexorable returns. The scientific quest found fertile soil only when this faith in a personal, rational Creator had truly permeated a whole culture, beginning with the centuries of the High Middle Ages. It was that faith which provided, in sufficient measure, confidence in the rationality of the universe, trust in progress, and appreciation of the quantitative method, all indespensable ingredients of the scientific quest.
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> . . ..
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> To this belief, science owes its very birth and life.1083/

1083. S. Jaki*, Science and Creation viii (1974).

Gilkey* (an ACLU witness in McLean) of University of Chicago reaches the same conclusion:

> [T]he idea of a transcendent Creator actually made possible rather than hindered the progress of the scientific understanding of the natural order. In a real sense the modern conviction that existence is good because it is intelligible to scientific inquiry finds some of its most significant roots in the Christian belief that God created the world.1084/

Other philosophers of science and scientists who have published similar conclusions include Whitehead*, Oppenheimer*, Foster*, Klaaren*, Calvin*, Hooykaas*, Eiseley*, and Weizzacker*.1085/

1084. L. Gilkey*, Maker of Heaven and Earth 110 (1959).

1085. A. Whitehead*, Science and the Modern World 12-13 (1925)("It must come from the medieval insistence on the rationality of God, conceived as with the personal energy of Jehovah and with the rationality of a Greek philosopher. . . . My explanation is that the faith in the possibility of science, generated antecedently to the development of modern scientific theory, is

Most of the individual founders of modern science believed in the existence of a

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an unconscious derivative from medieval theology."); Oppenheimer*, On Science and Culture, Encounter, Oct. 1962, at 62; Foster*, The Christian Doctrine of Creation and the Rise of Modern Natural Science, 43 Mind 448, 453, 465 (1934) ("The modern investigators of nature were the first to take seriously in their science the Christian doctrine that nature is created, and the main differences between the methods of ancient and the methods of modern natural science may be reduced to this" that these are and those are not methods proper to the investigation of a created nature. . . . The reliance upon the senses for evidence, not merely for illustration, is what constitutes the empirical character peculiar to modern natural science; and the conclusion follows that only a created nature is proper object of an empirical science."); E. Klaaren*, Religious Origins of Modern Science v, vii, 1 (1977) ("The chief purpose of this essay is to show that religion was conducive to the advent of modern science, specifically that belief in divine creation was a major presupposition in the emergence of natural science in seventeenth-century England."); M. Calvin*, Chemical Evolution 258 (1969); R. Hooykaas*, Religion and the Rise of Modern Science ____ (1972); L. Eiseley*, Darwin's Century: Evolution and the Men Who Discovered It 62 (1961); von Weizsacker*, The Relevance of Physics 163 (1964).

creator and in the creator's intervention in nature contrary to natural law, and in fact were creationists. Sir Francis Bacon, the "father of modern science," was a creationist whose purpose for studying science was to fulfill the command in Genesis to "subdue the earth."1086/ Sir Isaac Newton, the father of physics, discoverer of the laws of gravity, and inventor of calculus, was a creationist who believed that he was predestined to stand in the presence of the creator and share the Creator's secrets.1087/

1086. F. Bacon, Novum Organum cxxix (1___). Accord, F. Bacon, Advancement of Learning 5 (1900) ("To conclude, let no one weakly imagine that man can search too far, or be too well studied in the book of God's word and works, divinity or philosophy; but rather let him endeavor an endless progression in both, only applying all to charity and not to pride."); e.g., Bacon, A Confession of Faith, in 7 Works of Francis Bacon 221 (___).

1087. G. Christianson*, In the Presence of the Creator: Isaac Newton and His Times ___ (1984); R. Numbers*, Creation by

Robert Boyle, the father of chemistry, was a strong creationist, as were most of the early members of the Royal Society in England.1088/ Other creationist scientists included Johann Kepler, the founder of physical astronomy; Blaise Pascal, who developed analytic geometry, John Ray, who founded natural history; Nicholas Steno, who developed stratigraphy;

Natural Laws 5 (1977)("Newton's widely circulated condemnation of hypothesizing about creation by natural law and his insistence on the necessity of divine intervention left the distinct impression that 'Newtonianism and cosmogony were absolutely incompatible.'").

1088. G. Trevelyan*, English Social History ____ (1942) ("Robert Boyle, Isaac Newton, and the early members of the Royal Society were religious men, who repudiated the skeptical doctrines of Hobbes. But they familiarized the minds of their countrymen with the idea of law in the Universe and with scientific methods of enquiry to discover truth. It was believed that these methods would never lead to any conclusions inconsistent with Biblical history and miraculous religion; Newton lived and died in that faith."); e.g., Boyle, Some Motives and Incentives to the Love of God, in I Works of Robert Boyle 167 (1744).

William Harvey, who discovered the circulatory system; John Woodward, who founded paleontology; Carolus Linnaeus, who established the taxonomical system; and Michael Faraday, who developed electromagnetics and field theory.1089/ Mid-nineteenth century creationists included paleontologist Louis Agassiz, geologist Benjamin Silliman, physicists Lord Kelvin and James Clerk Maxwell, bacteriologist Louis Pasteur, and others,

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1089. 1 I. Lakatos*, The Methodology of Scientific Research Programmes 195 (J. Worrall & G. Currie eds. 1978) ("Scientific knowledge in the seventeenth century was regarded by most of its representatives as an integral part of theological knowledge: most scientists, like Descartes, Kepler, Galileo, Newton, and Leihniz, were after God's Blueprint of the Universe."); Patterson*, Cladistics and Classification, ____ New Scientist 303, 303 (1982) ("Linnaeus introduced his system partly as a convenient aid to memory, a means of making comprehensible the diversity of nature. But Linnaeus also had a higher purpose than to merely to catalogue nature. He believed that he was uncovering the plan of the Creator.").

as discussed below.1090/

Summary. Thus, creation-science and evolution are parallel in inferences drawn about the existence of a creator, and in neither case are those inferences necessarily religious. This is a material factual issue.

(5) Parallel Non-Religious Relation to World Views of Evolution and Creation-Science

Overview. There are world views that are consistent with evolution and creation-science, although evolution and creation-science are not necessarily a part of those world views. The world views consistent with evolution are materialism and naturalism, and positivism, and in the thought of some proponents theism and deism; and the world views consistent with (but different from)

1090. Section 3[d](2)(a) infra.

creation-science are theism, deism, and metaphysical dualism. Science necessarily presupposes something about God and a creator,1091/ and the world views of materialism, naturalism, and positivism logically rule out any deity or creator, while the world views of theism, deism, and metaphysical dualism require a God or Supreme Being The following sections discuss:

(a) Evolution and world views of materialism, naturalism, and positivism, (b) Evolution and controversial political views, and (c) Creation-science and world views of theism, deism, and metaphysical dualism.

Gillespie* frames the contrast as being between the two world views of "creation-

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1091. Section 3[b](4)(b) supra.

ism" and "positivism."1092/

(a) Evolution and World Views of Materialism, Naturalism, and Positivism. Philosopher Greene* acknowledges and describes the "evolutionary world view" as involving materialism and positivism, in the following words:

> Thus, by the middle of the nineteenth century all of the materials that were to be forged into a distinctive kind of evolutionary world view lay at hand--the law-bound system of matter in motion, evolutionary deism verging toward agnosticism under the influence of positivistic empiricism, the idea of organic evolution, the idea of a social science of historical development, faith in the beneficient effects of competitive struggle--all

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1092. N. Gillespie*, Charles Darwin and the Problem of Creation 224 (1979). See also Lewontin*, in Introduction to Scientists Confront Creationism xxvi (L. Godfrey ed. 1983) ("Yet, whatever our understanding of the social struggle that gives rise to creationism, whatever the desire to reconcile science and religion may be, there is no escape from the fundamental contradiction between evolution and creationism. They are irreconcilable world views.").

> these ideas lay waiting for the architect who could combine them into a single all-embracing synthesis.1093/

Marsden*, who was an ACLU history witness in the McLean case, similarly acknowledges the critical role of evolution in a world view:

> Evolution is sometimes the key mythological element in a philosophy that functions as a virtual religion.1094/

This world view can be seen to involve materialism, naturalism, and neo-positivism. As noted earlier, "evolutionary positivism" is one of "two fundamental kinds of positivism," and a "materialistic . . . metaphysics

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1093. J. Greene*, Science, Ideology and World View 133 (1981). Accord, Reexamination of the Foundations in Pensée, May 1972, at 44, _____ (interview with George Grinnell*) ("Darwin also did not derive his theory from nature but rather superimposed a certain philosophical world-view on nature and then spent 20 years trying to gather the facts to make it stick.").

1094. Marsden*, Creation versus evolution: no middle way, 305 Nature 571, 574 (1983).

is often associated with evolutionary positivism."1095/ A "modified form of Materialism is perhaps better described as naturalism."1096/

The consistency of materialism with early evolutionary theory is described by Hull:

1095. Abbagnano*, Positivism 6 Encyclopedia of Philosophy 414, 415 (P. Edwards ed. 1967);see Feigl*, Positivism and Logical Empiricism, 14 Encyclopaedia Britannica 877, 877 (15th ed. 1974).

1096. _____*, Metaphysics, 12 Encyclopaedia Britannica ___, 26 (15th ed. 1974).

> Darwin did not formulate evolutionary theory for the express purpose of helping to foster atheistic materialism, but that was one of its more significant consequences. It is no coincidence that almost all the early proponents of Darwinism were atheistic materialists--or their near relatives.1097/

Darwin* himself espoused "philosophical materialism,"1098/ and Haeckel*, a leading evolutionist, also advocated materialism.1099/

1097. Hull*, _____, in The Comparative Reception of Darwinism, 388, 391 (T. Glick ed. 1974).

1098. S. Gould*, Ever Since Darwin 24 (1977). Accord, J. Barzun*, Darwin, Marx, Wagner 7 (2d ed. 1958) ("Meantime I have spoken of [Darwin's, Marx's and Wagner's] contributions as forming a single stream of influence which I have called mechanical materialism: the cold world in which man's feelings are illusory and his will powerless."). T. H. Huxley* was similar. Id. at 66-67 ("Lest it be thought that I am exaggerating the religious aspects of Darwinism I must again refer to Huxley, whose remark about 'the Hegira of Science from the idolatries of special creation: and 'the purer faith of Evolution' was made, not in the enthusiasm of 1859, but after fifteen years' reflection. Huxley could truthfully call himself an agnostic and a religious man at the same time, for he was completely devout about the new faith.").

1099. E. Haeckel*, The Riddle of the

The evolutionist "majority of men of science held unconsciously a naive materialism" at the beginning of the twentieth century,1100/ and still do today as observed by Dobzhansky*:

Universe at the Close of the 19th Century (1899). Buchner* held parallel views. L. Buchner*, Force and Matter ___ (P. Eckler trans. 1891)("Matter must have been eternal . . . the universe must be uncreated . . .. Natural laws are immutable . . .. The experience of more than a thousand years has pressed on observers the conviction of the immutability of natural laws . . . with such absolute certainty that not the least doubt can remain . . .. With the most absolute truth and with the greatest scientific certainty can we say this day: There is nothing miraculous in the world . . .. Belief in God is therefore almost confined at the present time to those so-called learned men who know scarcely anything about natural processes . . .. Whatever theological interest or narrow-minded pendantry can urge in opposition to this is controverted by the strength of the facts, which in this respect leave no room for any doubt.").

1100. W. Dampier-Whetham*, A History of Science 445 (1951). Accord, A. Whitehead*, Science and the Modern World 17 (1925)("There persists, however, throughout the whole period the fixed scientific cosmology which presupposes the ultimate fact of an irreducible brute matter, or material, spread throughout space in a flux of configurations. In itself such a material is

> Monod has accomplished more than a delineation of his own world view. He has stated with admirable clarity, and eloquence often verging on pathos, the mechanistic materialist philosophy explicity or implicitly shared by most of the present 'establishment' in the biological sciences. But while many see this philosophy through a glass darkly, Monod makes it crystal clear.1101/

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senseless, valueless, purposeless. It just does what it does do, following a fixed routine imposed by external relations which do not spring from the nature of its being. It is this assumption that I call 'scientific materialism.' Also it is an assumption which I shall challenge as being entirely unsuited to the scientific situation at which we have now arrived. It is not wrong, if properly construed. If we confine ourselves to certain types of facts, abstracted from the complete circumstances in which they occur, the materialistic assumption expresses these facts to perfection. But when we pass beyond the abstraction, either by more subtle employment of our senses, or by the request for meanings and for coherence of thoughts, the scheme breaks down at once.")

1101. Dobzhansky*, A Biologist's World View, 175 Science 49, 49 (1972). Accord, T. Dobzhansky*, The Uniqueness of Man 43 (1969) ("Reductionism is now the semi-official creed of biological establishment."); Bethell, A Challence to Materialism, New Republic, Aug. 1, 1983, at 34, 34, 36 ("[T]he materialists have been waging war on the scientific pluralists. (How much better,

Others have noted this affinity between materialism or mechanistic philosophy and evolution.1102/

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after all, to officiate at the high altar than to sit in the pews.) It is not generally recognized, for example, that the current evolution/creation debate is an engagement in this war.").

1102. Provine* of Cornell writes:

> Evolutionists still disagree about the precise mechanisms of evolution in nature, but they have nevertheless given overwhelming support to Darwin's belief that design in nature results from purely mechanistic causes. . . . Here are the implications of this mechanistic view of life as I see them. First, except for purely mechanistic ones, no organising or purposive principles exist in the world. There are no gods and no designing forces.

Provine*, Implications of Darwin's Ideas on the Study of Evolution, 32 BioScience 501, 506 (1982). Accord, J. Greene*, Science, Ideology and World View 130 (1981) ("The oldest and most general component of the world view that came to be known as Darwinism was the idea of nature as a law-bound system of matter in motion, the mechanical view of nature (with its corollary of primary and secondary qualities) elaborated in the seventeenth century by Galileo, Descartes, Boyle, Newton, and others. To speculative thinkers like Descartes this mechanistic cosmology opened up the exhilarating prospect of deriving the present

The relation of naturalism to evolution was noted by Grene*, in saying that Darwinism "appears as the very keystone of the naturalistic universe."1103/ The con-

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structures of nature--stars, solar systems, and others--from a previous, more homogeneous state of the universal system of matter in motion by the operation of the laws of nature. 'Give me extension and movement and I will remake the world,' said Descartes."); G. Simpson*, The Meaning of Evolution 15 (1950) ("Nor is it necessary to suppose that the origin of the new processes of reproduction and mutation was anything but materialistic."); Elders, The Philosophical and Religious Background of Charles Darwin's Theory of Evolution, ____ Doctor Communis 1, 35 (1984) ("Summing up, we can say that Darwinism is not metaphysically neutral, but holds a materialistic and atheistic monism, which also rejects the spirituality of the human mind. It demands strict uniformity in natural process and excludes God's special intervention as well as general Providence.").

1103. Grene*, The Faith of Darwinism, Encounter, Nov. 1959, at 48, 48-49. Accord, id. at 48 ("under the benevolent banner of purely naturalistic nature"); see I. Barbour*, Science Ponders Religion 200 (1960) ("To be sure, naturalism is still a live option, but it is clear that it must be defended as a philosophical view point and not a conclusion of science.").

sistency of neo-positivism with evolution is evident in Greene's* description of the "evolutionary world view."1104/ Astronomer Carl Sagan*, an ACLU expert witness, provides a good example of materialism, naturalism, and positivism, and their close relation to evolution in his opening paragraph to Cosmos:

> THE COSMOS IS ALL THAT IS OR EVER WAS OR EVER WILL BE. . . .1105/
>
> . . ..
>
> It is the universe that made us, and we are creatures of the cosmos.1106/

Sir Julian Huxley* and other leading evolutionists have often reflected this same viewpoint.1107/

1104. Note 1093 supra; J. Grene*, Science, Ideology, and World View 148-49 (1981) ("From the tradition of British empiricism and the positivistic currents of the nineteenth century they imbibed a sturdy faith in the methods of natural science as man's sole and sufficient means of acquiring knowledge of reality.").

1105. C. Sagan*, Cosmos 4 (1980).

1106. C. Sagan*, Cosmos, tr. at _____ (television program 1981).

(b) Evolution and Controversial Political Views. Evolution has also been interpreted by some historical figures to be consistent with several highly controversial

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1107. Huxley*, _____ (19___) ("In the evolutionary pattern of thought there is no longer either need or room for the supernatural. The earth was not created, it evolved. So did all the animals and plants that inhabit it, including our human selves, mind and soul as well as brain and body. So did religion."); Huxley*, The Evolutionary Vision 3 Evolution After Darwin 249, 252 (S. Tax & C. Callender eds. 1960)("[I]t is evolution, in the broad sense, that links inorganic nature with life, and the stars with the earth, and matter with mind, and animals with man. Human history is a continuation of biological evolution in a different form"); F. Ayala*, _____, 68 Journal of Heredity 3-10 (1977) ("The place of biological evolution in human thought was, according to Dobzhansky, best expressed in a passage that he often quoted from Pierre Teilhard de Chardin, '[Evolution] is a general postulate to which all theories, all hypotheses, all systems must hence forward bow and which they must satisfy in order to be thinkable and true. Evolution is a light which illuminates all facts, a trajectory which all lines of thought must follow--this is what evolution is.'").

political views. Social Darwinism applied evolution and survival of the fittest to society.1108/ Marxism quickly adopted evolution, as Gould* notes:

> The most ardent materialists of the nineteenth century, Marx and Engels, were quick to recognize what Darwin had accomplished and to exploit its radical content. In 1869, Marx wrote to Engels about Darwin's Origin:
>
> > Although it is developed in the crude English style, this is the book which contains the basis in natural history for our view.
>
> Marx later offered to dedicate volume 2 of Das Kapital to Darwin, but Darwin gently declined, stating that he did not want to imply approval of a work he had not read.1109/

1108. R. Hofstadter*, Social Darwinism in American Thought (1955); D. Oldroyd*, Darwinian Impacts: An Introduction to the Darwinian Revolution, (1980).

1109. S. Gould*, Ever Since Darwin 26 (1977). Marx* wrote:

> But nowadays, in our evolutionary conception of the universe, there is absolutely no room for either a Creator or a ruler . . .."

K. Marx*, Marx and Engels on Religion 295 (1964). Accord, J. Barzun*, Darwin, Marx, Wagner 8 (2d ed. 1958) ("Some of the biographical connections are of course well known. It is a commonplace that Marx felt

In fact, Gould* writes that he "learned his Marxism, literally, at his daddy's knee," and compares punctuated equilibrium to Marxism.1110/ Racism also was heavily support-

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his own work to be the exact parallel of Darwin's. He even wished to dedicate a portion of Das Kapital to the author of The Origin of Species."); Elders*, The Philosophical and Religious Background of Charles Darwin's Theory of Evolution, ____ Doctor Communis 1, 29 (1984) ("Darwinism became an important driving force in favour of materialism. In a similar vein Friedrich Engels wrote to Marx: In one field teleology has not yet been destroyed. Darwin had now done this.").

1110. Gould* & Eldredge*, Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered, 3 Paleobiology __, 146 (1977) ("In the light of this official philosophy, it is not at all surprising that a punctational view of speciation, much like our own, but devoid (so far as we can tell) of references to synthetic evolutionary theory and the allopatric model, has long been favored by many Russian paleontologists. It may also not be irrelevent to our personal preferences that one of us [Gould] learned his Marxism, literally, at his daddy's knee."); id. at ____ Gould*, Evolution's Erratic Pace, Natural History, May 1977, at 13, 16 ("In the Soviet Union, for example, scientists are trained with a very different philosophy of change--the so-called dialectical laws, reformulated by Engels

ed by evolutionists:

> Biological arguments based on innate inferiority spread rapidly after evolutionary theory permitted a literal equation of modern 'lower' races with ancestral stages of higher forms. . . .
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> . . ..
>
> Biological arguments for racism may have been common before 1859, but they increased by orders of magnitude following the acceptance of evolutionary theory. The litany is familiar: cold, dispassionate, objective, modern science shows us that races can be ranked on a scale of superiority.
>
> . . ..
>
> At this point, I hasten to add that I am not selecting the crackpot statements of a bygone age. I am quoting the major works of recognised leaders.1111/

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from Hegel's philosophy. . . . Eldredge and I were fascinated to learn that most Russian paleontologists support a model very similar to our punctuated equilibria. The connection cannot be accidental.").

1111. S. Gould*, Ontogeny and Phylogeny 126-27, 130 (1977). Accord, 2 T. Wallbank* & A. Taylor*, Civilization Past and Present 361 (4th ed. 1961) ("The pseudoscientific application of biological theory to politics . . . constituted possibly the most perverted form of social Darwinism. . . . It led to racism and antisemitism and was used to show that only 'superior' nationalities and races were fit to survive.")

Darwin* predicted that the "lower races" would soon be eliminated by the "higher civilized races" through survival of the fittest,1112/ while many leading evolutionists in the late nineteenth and early twentieth century were leading white supremacists.1113/ Also, Naziism is described as

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1112. 1 The Life and Letters of Charles Darwin 316 (F. Darwin ed. 1888). Accord, Elders*, The Philosophical and Religious Background of Charles Darwin's Theory of Evolution, _____ Doctor Communis 1, 31 (1984) ("To a certain extent Darwin may be held responsible for this racism: in his The Descent of Man he repeatedly suggests that the black or primitive races stand between the animals and man. He compares the (bad) conduct of certain Indian tribes and of the Fidjians with that of animals."); J. Greene*, Science, Ideology, and World Views 150 (1981).

1113. J. Haller, Jr.*, Outcasts from Evolution 280 (1971); Brace*, The Roots of the Race Concept in American Physical Anthropology in A History of American Physical Anthropology 496 (F. Spencer ed. 1982); e.g., Osborn*, The Evolution of Human Races, 89 Natural History, April 1980, at 129 ("This is the recognition that the genus Homo is subdivided into three absolutely distinct stocks, which in zoology would be

follows:

> [Hitler] stressed and singled out the idea of biological evolution as the most forceful weapon against traditional religion and he repeatedly condemned Christianity for its opposition to the teachings of evolution. For Hitler, evolution was the hallmark of modern science and culture, and he defended its veracity as tenaciously as Haeckel.1114/

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given the rank of species, if not of genera, stocks popularly known as the Caucasian, the Mongolian, and the Negroid . . .. The standard of intelligence of the average adult Negro is similar to that of the eleven-year old youth of the species Homo sapiens."); A. Keith*, Evolution and Ethics ___ (1947).

1114. D. Gaeman*, The Scientific Origins of National Socialism: Social Darwinism in Ernst Haeckel and the German Monist League xvi (1971). Accord, A. Hitler*, Mein Kampf 239-40, 242 (4th ed. 1939) ("If nature does not wish that weaker individuals should mate with the stronger, she wishes even less that a superior race should intermingle with an inferior one; because in such a case all her efforts, throughout hundreds of thousands of years, to establish an evolutionary higher stage of being, may thus be rendered futile. But such a preservation goes hand-in-hand with the inexorable law that it is the strongest and the best who must triumph and that they have the right to endure. He who would live must fight. He who does not wish to fight in this world, where permanent struggle is the law of life, has not the right to exist.").

In these and other ways, evolution is consistent with various world views. To the extent evolutionists argue that creation-science is identical with the religion of world views with which it is consistent, they must treat evolution as identical with the controversial politics (and with the religions that are discussed below) with which is it consistent.

(c) Creation-Science and the World Views of Theism, Deism, and Metaphysical Dualism. Creation-science is consistent with (although not part of) the world views of theism, deism, and metaphysical dualism, to the same extent that evolution is consistent with the world views of materialism, naturalism, and neo-positivism. As described above, modern science actually arose from a world view of belief in a creator and the founders of various scientific fields were nearly all theists and creationists.1115/

Summary. Thus, evolution and creation-science are parallel in their consistency with world views. The world view with which creation-science is consistent is not peculiar or narrow, but is the world view from which modern science arose and that most great scientists held before the late nineteenth century. The materialistic, naturalistic, and neo-positivistic world view with which evolution is consistent rules out the existence of God or of a creator and bars any break in the rule of natural law as the philosophers and historians cited above have argued. These are material factual issues.

Conclusion. Creation-science and evolution are parallel in their relation to concepts of a creator, and such concepts are not part of or central to creation-science.

1115. Section 3[b](4)(d) supra.

The concept of creation is not religious, and in fact is a vital part of some scientific viewpoints such as the directed panspermia and continuous creation hypotheses and such as E.J. Ambrose's* and Heribert-Nilsson's* approaches, all of which firmly reject Genesis. These are material factual issues.

c. Material Factual Issues that Creation-Science and Evolution Are Equally NonReligious in Their Parallel Relations to Religion

Summary. Another group of material factual issues about the nonreligious nature of creation-science and evolution involves various allegedly religious aspects of creation-science that are equally applicable to evolution. Just as creation-science is consistent with numerous religious faiths spanning the theological spectrum, evolution is equally consistent with many religious faiths that also span the spectrum, as Sec-

*Note: Theologians and others cited in this Section [c], unless otherwise indicated, are not creationists, and their quoted statements are not intended as endorsements of creation-science. However, their quoted statements are acknowledging information that creationist theologians and philosophers interpret as supporting the equally nonreligious nature of creation-science and evolution.

tion (1) demonstrates. It is simply not accurate to say that creation-science is primarily advocated by Fundamentalists while evolution is primarily advocated by scientists. Just as creation-science includes some scientific writers with strong personal religious beliefs and publications, evolution has scientific supporters with strong religious beliefs and publications, as discussed in Section (2). Thus, creation-science and evolution are parallel in these characteristics, and these characteristics do not render either scientific explanation religious. These general parallels were recently noted by Patterson*:

> So in general I am trying to suggest two themes. The first is that <u>evolutionism and creationism seem to have become very hard to distinguish</u>, particulary lately. I have just been showing how Gillespie's bitterest characterization of creationism seems to be, as I think, applicable to evolutionism--a sign that the two are very similar.
>
> . . ..

> So that is my first theme: that evolution and creation seem to be sharing remarkable parallels that are increasingly hard to tell apart.1118/

These are material factual issues.

(1) Non-Religious Nature of the Parallel Consistency with Various Religions of Evolution and Creation-Science

Overview. Both explanations of origins are consistent with many religions, and in fact the religious faiths in the United States divide almost evenly between creation and evolution. This division internally splits Protestant, Catholic, Jewish, and nonJudeo-Christian faiths. The left column lists religions with which creation-science is consistent, and the right column covers religions with which evolution is consistent:

1118. Address of Dr. Colin Patterson at American Museum of Natural History, tr. at 3 & 4 (Nov. 5. 1981) (speaking of creationism and evolution generally and not of consistency with religions specifically.).

Theological Category	Creationist Religions	Evolutionist Religions
(i) Protestant:	Conservative Evangelicalism & Fundamentalism; Church of Christ & Seventh-day Adventism;	Religious Humanism & Unitarianism; Theological Liberalism & NeoOrthodoxy;
(ii) Catholic:	Much Orthodox Roman Catholicism & Eastern Orthodoxy;	Neo-Modernist Roman Catholicism;
(iii) Jewish:	Orthodox Judaism; and	Reform Judaism; and
(iv) Non-Judeo-Christian:	Islam (Muslims) etc.	Buddhism & Hinduism Secular Humanism & other Humanist faiths, Nontheistic religions & Atheism.

Evolution is harmonious or consistent with as many religions and to the same extent that creation-science is.

Such harmony between scientific explanation and religious belief does not violate the establishment clause. As the Supreme Court said in McGowan v. Maryland,1119/ "the 'Establishment' Clause does not ban federal or state regulation whose reason or effect merely happens to coincide or harmonize with the tenets of some or all religions."1120/ The Court in McGowan sustained a Sunday closing law despite its consistency with many religions, and noted that "the fact that [the illegality of murder] agrees with the dictates of the Judaeo-Christian religions while it may disagree with others

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1119. 366 U.S. 420 (1961).

1120. Id. at 442. Accord, Lynch v. Donnelly, ___ U.S. ___, 104 S.Ct. ___, ___ (1984); Harris v. McRae, 448 U.S. 297, ___ (1980); Part B. Section 2[c](4) infra.

does not invalidate the regulation . . .. The same could be said of theft, fraud, etc., because those offenses were also proscribed in the Decalogue."1121/ In Harris v. McRae,1122/ the Supreme Court recently upheld a restriction on governmental funding of abortions despite consistency with Roman Catholicism and other religious belief.1123/ For example, many people believe that Caesar Augustus was Emperor of Rome and that Nebuchadnezzar was King of Babylon on the basis of Bible references, yet these facts are also established by secular historical data. The mere consistency of these facts with some religious views does not render either fact religious or make either fact inappropriate for public school instruction

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1121. Id. at 442.
1122. 448 U.S. 297 (1980).
1123. Id. at ____. Accord, Lynch v. Donnelly, ___ U.S. at __, 104 S.Ct. at ___.

based on secular historical data. The mere harmony or consistency of creation-science and evolution with many religions and their doctrines similarly does not render inherently religious either of those scientific explanations.

(a) Evolutionist Religions. Many religious faiths have evolutionist religious doctrines, and evolutionist religions span the entire religious spectrum to include Protestant, Catholic, Jewish, and non-Judeo-Christian faiths. Examples of evolutionist religions are:

Protestant:	(i)	Religious Humanism & Unitarianism
	(ii)	Theological Liberalism, and
	(iii)	NeoOrthodoxy;
Catholic:	(iv)	Neo-Modernist Roman Catholicism
Jewish:		
Non-Judeo-	(v)	Reform Judaism;
Christian:	(vi)	Buddhism & Hinduism,
	(vii)	Secular Humanism & other Humanist faiths,

(viii) Nontheistic religions, and
(ix) Atheism.

These evolutionist religions are evident in the recent theological book entitled Is God a Creationist? The Religious Case Against Creation-Science.1123a/ The argument is not that evolution is religious, but that evolution and creation are nonreligiously parallel in that evolutionist religious doctrines are held by the many religions that are described in the following paragraphs.

(i) Religious Humanism and Unitarianism. Religious Humanism includes evolution as a theological doctrine. Religious Humanism is presented by the first Humanist Manifesto,1124/ which was signed primarily by

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1123a. Is God a Creationist? The Religious Case Against Creation-Science (R. Frye* ed. 1983).

1124. Humanist Manifesto I, in Human-

theologians and characterized its position as describing the "religion" of the "[r]eligious humanists."1125/ Four of the fifteen points of the Humanist Manifesto explicitly affirm evolution; point 1 states that "Religious Humanists regard the universe as self-existing and not created," while point 2 affirms the evolution of man.1126/ John Dewey*, the "most influen-

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ist Manifestos I and II (P. Kurtz ed. 1973), reprinted from New Humanist, May-June 1933, at 1.

1125. Id.; Wilson*, The Religious Element in Humanism Pervades Its Origin, Inspiration and Support, 22 Humanist 173, 173 (1962) ("Of the 34 persons who signed the Humanist Manifesto in 1933, all but four can be readily identified as religious humanists who considered Humanism as the development of a better and truer religion . . .."). Accord, C. Potter*, Humanism: A New Religion 114 (1930) ("Is Humanism a religion? It is both a religion and a philosophy of culture."); J. Auer*, Humanism States Its Case, the Lowell Institute lectures, delivered in King's chapel, Boston, Massachusetts, during February and March, 1932 (1933).

1126. Humanist Manifesto I, supra note 1124, at 8.

tial" modern educator, signed and substantially drafted this Humanist Manifesto.1127/ Today, Humanism is "the dominant religion of our time," in the words of biologist Ehrenfeld* of Rutgers (in a book published by Oxford University Press);1128/ and some Humanists see themselves as "proselytizers of a new faith" "in the public school classroom by teachers."1128a/ One

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1127. J. Hitchcock*, What Is Secular Humanism? (1983); see McNaughton*, John Dewey and Religious Humanism, Religious Humanism, Spring 1980, at 58, 67 (Dewey* concluded his book, A Common Faith, with the following words: "Here are all the elements for a religious faith that shall not be confined to sect, class, or race. Such a faith has always been implicitly the common faith of mankind. It remains to make it explicit and militant.").

1128. D. Ehrenfeld*, The Arrogance of Humanism __ (1978). Accord, Ochs*, The Religion of Liberal Humanism, 8 NICM Journal 93, 93-94 (Spring-Summer 1983).

1128a. Dunphy*, The New Faith of Humanism and Teachers, Humanist, Jan.-Feb. 1983, at ___ ("I am convinced that the battle for humankind's future must be waged and won in the public school classroom by teachers who correctly perceive their role

current group that advocates Religious Humanism is the Fellowship of Religious Humanists, which is concededly religious and explicitly evolutionist;1129/ it is "affili-

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as the proselytizers of a new faith: a religion of humanity that recognizes and respects what theologians call divinity in every human being. These teachers must embody the same selfless dedication as the most rabid fundamentalist preachers, for they will be ministers of another sort, utilizing a classroom instead of a pulpit to convey humanist values in whatever subsubject they teach, regardless of the educational level--preschool day care center or large state university. The classroom must and will become an arena of conflict between the old and the new--the rotting corpse of Christianity, together with all its adjacent evils and misery, and the new faith of humanism. . . . It will undoubtedly be a long, arduous, painful struggle replete with much sorrow and many tears, but humanism will emerge triumphant. It must if the family of humankind is to survive.").

1129. Humanism, A New Religion, Religious Humanism, Spring 1968, at 96, 96 (point 1 of 10 points: "The world and man evolved."); Mason*, Religious Humanism: 19th and 20th Centuries, Religious Humanism, Winter 1979 at 3, 13 ("That is indeed a religious humanism whose roots have supported strong branches and whose tree has borne fruit."); Hemstreet*, On Being Religious,

ated with the American Ethical Union, the American Humanist Association, the Unitarian-Universalist Association, and the International Humanist and Ethical Union," as well as the Society for Humanistic Judaism."1130/ The American Humanist Association was organized by "a group composed primarily of liberal ministers and professors who were predominantly Unitarians and

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Humanistically, Religious Humanism Winter, 1981, at 24, 40 ("I belong to and support as generously as possible with money and time those organizations that express and promote humanistic and liberal values--the Unitarian Universalist Church, the Fellowship of Religious Humanists, the American Humanist Association, Amnesty International, the American Civil Liberties Union, and the Democratic Socialist Organizing Committee."); Farmer*, Must the Moral Majority Monopolize the "Good" Words?, 41 Humanist 32 (May-June 1981); Smudski*, Evolution: The Way of Growth, 13 Religious Humanism 79 (1979); Beattie*, Humanism: Secular or Religious, 1 Free Inquiry 11 (Winter 1980-81); Haydon*, Is Scientific Humanism Religious?, 2 Religious Humanism 49 (1968).

1130. C. Lamont*, The Philosophy of Humanism 85 (1977).

considered themselves religious humanists," according to a former president (although it currently includes mostly Secular Humanists and other Humanists).1131/ The Churchman is an "independent journal of religious humanism."1132/ Evolution is an important point of Religious Humanist doctrine, as the Humanist Manifesto indicates.1133/

1131. Wilson*, The Religious Element in Humanism Pervades Its Origin, Inspiration and Support, 22 Humanist 173, 173 (1962). E.g., id. at 1131 ("So in that sense Humanism is a religion, albeit a secular one."); Arisian*, A New Statement of Religious Humanism, Humanist, Mar.-Apr. 1977, at 54, 54.

1132. Churchman*, Mar. 1983, at 3.

1133. Potter*, Humanism, A New Religion, Religious Humanism, Spring, 1968 at 96, 96 ("The world and man evolved."); Hemstreet*, On Being Religious, Humanistically, Religious Humanism 24, 29-30 (Winter 1981) ("To me, being religious as a liberal humanist involves the following attitudes and activities: 1. Revering life, especially human life, recognizing that it is probably necessary to deprive certain nonhuman species of life in order to protect, preserve, and enhance our human life. This reverence may extend to awe at the complexity and power of natural forces guiding the universe as a whole and a desire to understand those

(ii) Theological Liberalism. Theological Liberalism encompasses doctrinal belief in evolution. Theological Liberalism arose through the primary "formative factor" of evolution.1134/ Its leading Theologians

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powers and cooperate with them to further the process of cosmic evolution as a whole. As a conscious, intelligent human being, I am a cooperating part of that evolutionary process. . . ."); M. Olds*, Religious Humanism in America: Dietrich, Reese and Potter ___ (1977); C. Potter*, Humanist: A New Religion 15 (1930) ("Through his scientific study of the universe man has arrived at the theory of evolution. In this also, the Humanist finds himself at variance with many Theists."); Sellars*, Religious Humanism, New Humanist, May-June 1933, at 7.

1134. K. Cauthen*, The Impact of American Religious Liberalism 7 (1962). He points out the tie between evolution and Theological Liberalism:

> It would be difficult to overemphasize the influence of the doctrine of evolution in all of its forms on theology. The combination of evolution and immanence goes a long way toward providing the basic context out of which liberalism came and in which it grew.

Id. at 22.

> The impact of modern science in breaking down the orthodox scheme was decisive . . .. Mechanical causation appeared to be supreme, leaving little

have almost all incorporated evolution into their theology.

> or no room for special divine activity. Thus, the gap between general and special revelation . . . was acutely called into question. . . .
>
> Moreover, the doctrine of evolution narrowed the gap between nature and man and, along with the developmental theories regarding the origin of the solar system and the earth, emphasized the fact that the whole natural world was characterized by a unity of process. . . .
>
> By virtue of these influences modern science had both a negative and a positive effect upon the development of theology. Its negative effect was to call into question the world view which had been believed for centuries upon the authority of the Scriptures . . .. It also called into question the possibility of miracles . . .. The positive effect of science was to prepare the way for a doctrine of God's immanence in which divine activity was found not in miraculous intervention into the normal sequences of cause and effect but in the law-abiding evolutionary process of nature itself.

Id. at 7. Accord, Meland*, Liberalism, Theological, in 13 Encyclopaedia Britannica 1021, 1022 (W. Preece ed. 1965) ("The decisive events" giving rise to religious Liberalism in the late nineteenth and early twentieth centuries were "the publication of Darwin's Origin of Species" along with the industrial revolution.").

The leading Theological Liberals in the late nineteenth century are discussed in a recent scholarly book entitled The Post-Darwinian Controversies.1135/ (published by Cambridge):

1135. J. Moore*, The Post-Darwinian Controversies 304-05 (1979) [hereinafter cited as J. Moore]. He summarized the Theological Liberalism of these individuals:

> The Darwinists, in contrast, were overwhelmingly committed to theological reconstruction. There were neologians, striving to assimilate faith to scientific speculation and religious experience, discarding traditional views whenever expedient and rendering the residue in a form acceptable to their contemporaries. St. George Mivart's autonomous rationalism earned him the epithet 'modernist' and brought about his expulsion from the Roman Catholic Church. Frederick Temple fared somewhat differently in the Church of England, becoming archbishop of Canterbury, but this despite his consistent latitudinarianism, from his contribution to Essays and Reviews onwards. John Bascom rejected the 'perverse theory' of Calvinism on which he had been reared and elaborated a philosophy which 'belonged to the most liberal form of Christian apologetics'. Joseph Le Conte was--to use his own words--at 'first orthodox of the orth-

Rev. Frederick Temple* (Anglican,

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odox; later as thought germinated and grew apace, I adopted a liberal interpretation of orthodoxy; then, gradually I became unorthodox; then, in deep sympathy with the most liberal movement of Christian thought; and finally, to some extent, a leader in that movement'. Thomas Howard MacQueary's evolutionary and iconoclastic approach to Christian doctrines cost him his clerical career in the first outcome of a heresy trial in the history of the Protestant Episcopal Church. Lyman Abbott, believing the New Theology to be an advance over the New School Calvinism he had formerly accepted, was America's leading representative of evangelical liberalism. Francis Howe Johnson, perhaps the weightiest of the 'Andover liberals,' also moved far from his Calvinist heritage in assimilating Christian doctrine to a personalist philosophy. George Matheson, a 'conspicuous representative of liberal theology,' retained the doctrinal forms of conventional Calvinist orthodoxy but invested them with a new Hegelio-Spencerian meaning. 'I am as broad as can be,' he said, 'but it is a broad positive.' Henry Ward Beecher was similarly expansive, though with neither the philosophical sophistication nor the consistently positive approach. 'I am an evolutionist,' he declared, 'and that strikes at the root of all medieval and orthodox modern theology.' Minot Judson Savage and John Fiske, like

Archbishop of Canterbury);1136/
Rev. Henry Ward Beecher* (Congregational minister);1137/
Rev. George Henslow* (Anglican minister & botanist);1138/
Hon. George Douglas Campbell*, Duke of Argyll (politician);1139/

Beecher, jettisoned Calvinism for the theological liberties of the Synthetic Philosophy but both became Unitarians in the process. Henry Drummond was twice subjected to charges of heresy, in 1892 and 1895, and on the latter occasion no less than twelve overtures were made to the General Assembly of the Free Church of Scotland regarding his Ascent of Man.
Id. at 304-05.

1136. F. Temple*, Relations between Religion and Science 113-14, 167 (1885); Temple*, Essays and Reviews, in _____ (1860); see generally J. Moore* at 220.

1137. H. Beecher*, Evolution and Religion 113-15 (1885); see generally J. Moore* at 220-21.

1138. G. Henslow*, Present-day Rationalism Critically Examined (1904); G. Henslow*, The Origin of Floral Structures vi, xi, 335 (1888); G. Henslow*, The Theory of Evolution of Living Things (1873); G. Henslow*, Genesis and Geology (1871), see generally J. Moore* at 221, 232-34.

1139. G. Campbell*, Organic Evolution Cross-Examined 44, 64, 149, 155, 162 (1898); G. Campbell*, Unity of Nature 262 (1884); G. Campbell*, Primeval Man (1869); see generally J. Moore* at 221-22.

Rev. St George Mivart* (Roman Catholic lay theologian & biologist);1140/
Rev. John Bascom* (Congregational minister & professor);1141/
Rev. Henry Drummond* (Free Church minister); 1142/
Rev. Thomas Howard MacQueary* (Episcopal minister);1143/
Rev. Lyman Abbott* (Congregational minister);1144/
Rev. Francis Howe Johnson* (Congregational minister);1145/

1140. S. Mivart*, Lessons from Nature 274-77 (1876); S. Mivart*, Man and Apes (1873); S. Mivart*, On the Genesis of Species 277, 314 (1871); see generally J. Moore* at 222-23.

1141. J. Bascom*, Evolution and Religion 10-11, 13, 16 (1897); J. Bascom*, Natural Theology 128, 144-45 (1880); J. Bascom, Science, Philosophy, and Religion 228-29 (1871); see generally J. Moore* at 223-24.

1142. H. Drummond*, Ascent of Man 15-16, 44-45, 414, 418, 429, 435, 436 (1894); H. Drummond*, Natural Law in the Spiritual World (1883); see generally J. Moore* at 224.

1143. T. MacQueary*, The Evolution of Man and Christianity x, 16, 229-30 (rev. ed. 1891); T. MacQueary*, Topics of the Times (1891); see generally J. Moore at 225-26.

1144. L. Abbott*, The Theology of an Evolutionist iii, 6-10, 19, 20, 176 (1897); L. Abbott*, The Evolution of Christianity 1, 3, 8-9, 246-47 (1892); see generally J. Moore* at 226-27.

1145. F. Johnson*, What Is Reality? 260-65, 272, 276, 282-83, 3 2, 493 (1891); see generally J. Moore* at 227-28.

Rev. George Matheson* (Church of Scotland minister);1146/
Rev. Minot Judson Savage* (Church of the Unity minister);1147/
Rev. John Fiske* (Congregational then Unitarian philosopher);1148/
Rev. Joseph S. Van Dyke* (Presbyterian minister);1149/
Rev. James Iverach* (Free Church minister);1150/ and

1146. G. Matheson*, Can the Old Faith Live with the New? 7980, 86-87, 91, 157-58 (1885); see generally J. Moore at 228-29.

1147. M. Savage*, The Evolution of Christianity (1892); M. Savage*, The Irrepressible Conflict between Two World Theories 11, 26 (1892); M. Savage*, Evolution and Religion from the Standpoint of One Who Believes in Both 32-34 (1886); M. Savage*, The Morals of Evolution 166 (1880); M. Savage*, The Religion of Evolution 47, 59 (1876); see generally J. Moore* at 229-30.

1148. J. Fiske*, Life Everlasting (1901); J. Fiske*, Through Nature to God (1899); J. Fiske*, The Idea of God as Af-Affected by Modern Knowledge 129-30, 150-51 (1885); J. Fiske*, The Destiny of Man (1884); J. Fiske*, Darwinism and Other Essays 2-3 (rev. ed. 1885); J. Fiske*, Outlines of Cosmic Philosophy (1874); see generally J. Moore* at 230-31.

1149. J. Van Dyke*, Theism and Evolution xvii-xxi, 24-34, 41-47 (1886); see generally J. Moore* at 241-45.

1150. J. Iverach*, Christianity and Evolution (1894); J. Iverach*, Theism in the Light of Present Science and Philosophy (1899); J. Moore* at 253.

Rev. Aubrey Lackinton Moore* (Anglican minister).1151/

The theological beliefs and publications of these Theological Liberals all incorporated and featured evolution. The central role of evolution in their theology is reflected in such titles of their books as Beecher's* Evolution and Religion, Henslow's* Genesis and Geology, MacQueary's* The Evolution of Man and Christianity, Abbott's* The Theology of an Evolutionist, and Savage's* Evolution and Religion from the Standpoint of One Who Believes in Both. For example, Henry Ward Beecher*, the pastor of the country's largest congregation and one of the nation's most popular preachers, wrote:

> In every view of it, I think we are to expect great practical fruit from the

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1151. A. Moore*, Evolution and Christianity (1889); Moore*, Darwinism and the Christian Faith, in A. Moore', Science and the Faith 166, 167 (1889); J. Moore* at 259-62.

> application of the truths that flow now from the applicaion of Evolution. . . . Old men may be charitably permitted to die in peace, but young men and men in their prime are by God's providence laid under the most solemn obligations to thus discern the signs of the times, and to make themselves acquainted with the knowledge which science is laying before them.1152/

During the late 1800's, the leading evolutionists were generally theologians while the leading anti-evolutionists and creationists were generally scientists.1153/

The foremost Theological Liberals in the early twentieth century can readily be identified from Encyclopaedia Britannica:1154/

Rev. Edward Scribner Ames*;1155/

1152. H. Beecher*, _____.

1153. Sections 3[d](1)(a) and 3[d](2)(a) infra.

1154. Meland*, Theological Liberalism, 13 Encyclopaedia Britannica 1021, 1021-22 (13th ed. 1965) (also listing some others).

1155. Ames* wrote:

> Many of the problems long prominent in religion may find their answers through the discoveries of science. One of these is the problem of creation. By finding out how nature works . . .

Rev. William Newton Clarke*;1156/
Rev. George A. Coe*;1157/
Rev. Harry Emerson Fosdick*;1158/
Rev. Shailer Mathews*;1159/.

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there may come knowledge of the nature of life itself. Already the astronomers tell of the beginnings . . . of heavenly bodies . . .. The rough outline of man's life on the earth has become clear to anthropologists . . .. E. Ames*, Religion 84 (1929).

1156. Clarke* stated that, because "theology should remand the investigation of the time and manner of the origin of man to the science of anthropology with its kindred sciences, just as it now remands the time and manner of the earth to astronomy and geology, and should accept and use their discoveries on the subject," theology "will receive from them an evolutionary answer" and "special creation . . . may come to appear improbable." Thus "Genesis will be regarded . . . as the record of a human tradition or conception of beginnings, and not as a literal narrative of occurrence." W. Clarke*, An Outline of Christian Theology 223, 224, 225 (9th ed. 1984).

1157. Coe* believed that the essential truth of "the application of the theory of evolution to the whole of man's nature" and "belief in the immanence of God in nature and in man" "may be said to be already established." G. Coe*, The Religion of a Mature Mind 8 (1902).

1158. Fosdick* is quoted in note 1163 infra.

1159. Mathews* wrote that Modernism "trusts Him--the awful, mysterious God of

Rev. Walter Rauschenbusch*;1160/ and

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abysmal space, of galaxies, of stars, of ether, of evolution, of human liberty--as Father." S. Mathews*, The Faith of Modernism 118 (1936). He further stated that "Modernists . . . accept the results of scientific research as data with which to think religiously," and so a Modernist "is frankly and hopefully an evolutionist because of facts furnished by experts." Id. at 29-30. See also Hutchinson*, The Modernist Impulse in American Protestantism 275 (1976) ("Shailer Mathews of the University of Chicago was the most prominent spokesman during the twenties--rivaled only by Fosdick--for both of these arguments. Fosdick's outspoken eloquence, and his involvement in a notorious public controversy, made him known to an especially wide circle of Americans. But Mathews, as dean of the divinity school that had become a sort of modernist headquarters, stood forth as the leading statesman, politician, historian, and systematic spokesman for the movement.").

1160. Rauschenbusch* emphasized:

> According to orthodox theology, man's nature passed through a fatal debasement at the beginning of history. According to evolutionary science the [physical] impulses . . . run far back in the evolution of the race . . ., whereas the . . . spiritual impulses are of recent development and relatively weak. We can take our choice of the explanations, but there are defects in the doctrine of original sin.

Rauschenbusch*, Sin: Its Reality and Power, in A Gospel For The Social Awakening 77, 91-92 (B. Mays ed. 1950).

Rev. Ernst Troeltsch*.1161/

Their theological writings also all have included and emphasized evolution.1162/ For example, Rev. Harry Emerson Fosdick* wrote that "[w]e hold a worldview whose structual bases were not laid down by Moses in the thirteenth century B.C.," but by "the evolutionary hypothesis."1163/

1161. Troeltsch* wrote:

> In and of itself this concept ["of evolutionary development"] is one of the most reliable working tools there is, and it is one of the fundamental presuppositions of the scientific study of history. It has proved its worth beyond all shadow of doubt and corresponds to all knowable processes.

E. Troeltsch*, The Absoluteness of Christianity And The History of Religions 72-73 (D. Reid trans. 1971).

1162. Other examples of Theological Liberals who were evolutionists are E. Aveling*, The Gospel of Evolution (1884); H. Beecher*, Evolution and Religion (1885); E. Lyon*, The Meaning and Truth of Religion (1933); D. Macintosh*, Theology as an Empirical Science 253-54 (1919).

1163. H. Fosdick*, The Modern Use of the Bible 50-51 (1924). Fosdick* further stated:

Theological Liberalism at present still holds to a religious belief in evolution.1164/ Theological Liberalism is the viewpoint of

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> the more facts we know the better founded does the hypothesis appear. . . . We have not kept the forms of thought and categories of explanation in astronomy, geology, biology which the Bible contains. We have definitely and irrevocably gotten new ones diverse from and irreconcilable with the outlooks . . . the Bible in particular had.

Id.

1164. D. Miller*, The Case for Liberal Christianity (1981) (evolutionist and Humanist); Stiernotte*, Liberal Religion and the Sciences, in Together We Advance 79, 81-82 (S. Fritchman ed. 1946).

A good example of religious evolutionist doctrines of Theological Liberalism is provided by the following "Statement of Faith" that was recited by 1000 ministers and delegates at a National Council of Churches convocation:

Leaders Reading	People Reading
Some thousands of millions of years ago a fragment of matter composed of particularly stable atoms	WE BELIEVE IN GOD: WHO CALLS
was detached from the surface of the sun	THE WORLDS

such ACLU expert witnesses Walter Harrel-

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this fragment began to condense, to roll itself up, to take shape
The curve doubles back, the surface contracts, the solid
disintegrates, the liquid boils, the germ cell divides, intuition suddenly bursts
We are responsible for the quality of our future. We are evolving into an interdependent whole of which every person is called upon to become a vital part
Every organization insensitive to our need for personal involvement in the well-being of our fellow humans is disintegrating
Shock troopers of evolutionary change are now attacking all separatist structures
Whoever has discovered . . . the secret of serving

INTO BEING,

CREATES US AND SETS BEFORE US THE WAYS

OF LIFE

AND DEATH, WHO JUDGES PEOPLE AND NATIONS: TO BE CHRIST'S SERVANTS IN THE SERVICE OF HUMAN KIND.

son*,1165/ Dean V. Fowler*,1166/ Bishop Kenneth Shamblin*, and James Stovall*. It is a viewpoint held by a large number of churches.1167/

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the evolving Universe
and identifying with
it . . ..
BLESSING AND HONOR, GLORY AND POWER BE UNTO HIM. AMEN.

A Blending of Readings from Pierre Teilhard de Chardin: The Phenomenon of Man and the Divine Milieu; The Center Letter #1 and #5 and the Statement of Faith of the United Church of Christ.

National Council of Churches*, A Statement of Faith, Program of __ Convention (Nov. 6, 19__).

1165. Deposition of Walter Harrelson* at ___, Keith v. Louisiana Department of Education, No. 81-989B (M.D. La., filed Dec. 2, 1981).

1166. Deposition of Dean V. Fowler* at ___, id.

1167. Theological Liberalism is embraced by a large proportion of ministers, seminary professors, and members of major religious denominations such as:

	Ministers	Seminary Professors
United Methodists	33.8%	69%
Episcopals	25.7%	78%
American Baptists	17.9%	54%
United Presbyterian Church	18.4%	63%
American Lutheran Church/Lutheran	12.9%	52%

(iii) NeoOrthodoxy. NeoOrthodoxy also generally incorporates evolution, as is evident in the theological writings of such "leading exponents"1170/ as Reinhold Niebuhr*,1171/ Emil Brunner*,1172/ and Paul

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United Church of Christ -- 53%

Institute for Educational Affairs and Roper Center, What Theologians Believe, This World, Summer 1982, at 27, 72 (data on seminary professors); J. Hadden The Gathering Storm in the Churches 39, 75 (1969) (data on ministers).

1170. Jewett*, Neo-Orthodoxy, Baker's Dictionary of Theology 375, 375 (E. Harrison ed. 1960). Karl Barth*, however, "has specialized in ambiguity on the whole matter of the relation of primal history [Genesis 1-11] to empirical fact." Id. at 377. See also Chadwick*, Protestantism--The Twentieth Century--The Rise of NeoOrthodoxy, 15 Encyclopaedia Britannica 119-20 (15th ed. 1975).

1171. G. Wurth, Niebuhr 26-27 (1960) ("What is true of creation, namely, that it is in essence a myth, is equally valid of the fall of man.").

1172. Brunner* wrote:

> This whole historic picture of 'the first man' has been finally and absolutely destroyed for us to-day. The conflict between the teaching of history, natural science and palaeon-

Tillich*.1173/ For example, Tillich* stated:

> The dynamics of nature create the new by producing individuality in the smallest parts as well as in the largest composites of nature and also by producing new species in the evolutionary process and new constellations of matter in the extensions and contractions of the universe. But there is a qualitative difference between these forms of the new and the new in history proper. The latter is essentially related to meanings or values. Both terms can be adequate if correctly defined.

> tology, on the origins of the human race, and that of the ecclesiastical doctrine, waged on both sides with the passion of a fanatical concern for truth, has led, all along the line, to the victory of the scientific view, and to the gradual but inevitable decline of the ecclesiastical view.
>
> . . . .
>
> Far more important than this external reason for giving up the story of Adam and Eve is an inner one . . . .

E. Brunner*, Man in Revolt 85, 86, 88 (O. Wyon trans. _____).

1173. P. Tillich*, Systematic Theology 20 (1951)("The theological problem arising from the differences between the organic and the inorganic dimensions is connected with the theory of evolution and the misguided attacks on it on the part of traditional religion.").

> Most philosophies of history in the last one hundred years have spoken of history as the realm in which values are actualized. . . .
>
> . . ..
>
> If this were true, there would be no prehistorical man, and historical man would be a "creation out of nothing." But all empirical evidence stands against such an assumption. Prehistorical man is that organic being which is predisposed to actualize the dimensions of spirit and history and which in his development drives toward their actualization. There is no identifiable moment when animal self-awareness becomes human spirit and when human spirit enters the historical dimension. . . . If evolution proceeded only by leaps, one could identify the result of each leap. If evolution proceded only by a slow transformation, no radical change could be noticed at all. But evolutionary processes combine both the leap and the slow change, and therefore, although one can distinguish the results, one cannot fix the moments in which they appear. The darkness which veils prehistorical mankind is not a matter of preliminary scholarly failure but rather of the indefiniteness of all evolutionary processes with respect to the appearance of the new. . . .1174/

NeoOrthodoxy is the viewpoint generally of

1174. P. Tillich*, Systematic Theology 303, 307 (1951).

ACLU expert witness Langdon Gilkey*.1175/ NeoOrthodoxy is embraced by large elements within several major Protestant denominations as well as within Roman Catholicism.1176/

(iv) Neo-Modernist Roman Catholicism. Neo-Modernist Roman Catholicism generally holds evolution as part of its theology (just as Orthodox Roman Catholicism often or generally accepts creation), as a book on neo-Modernist Catholicism (published by

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1175. L. Gilkey*, Maker of Heaven and Earth--The Christian Doctrine of Creation in the Light of Modern Knowledge __ (1959); L. Gilkey*, Religion and the Scientific Future: Reflections on Myth, Science and Theology (1970).

1176. NeoOrthodoxy is embraced by a large proportion of ministers and members in major denominations such as:

	Ministers
United Methodists	31.8%
Episcopalians	30.1%
American Baptists	15.4%
United Presbyterian Church	41.2%
American Lutheran Church	23.5%

J. Hadden*, supra note 1167, at 39, 75. See also Institute for Educational Affairs and Roper Center*, supra note 1167, at 72.

Harvard) observes:

> Conservatives stubbornly defended the belief that God created man directly, constituting him a species immutably distinct from all other animals. . . . The liberals followed Asa Gray and John Fiske in believing evolution perfectly compatible with theism. . . . Zahm agreed with Fiske that this view was more devout than one which confirmed God's creativity to the first days of the world; it enabled the 'unbiased and reverent' to see 'in nature the evidence of a Power which is originative, directive, immanent.' Liberal Catholics agreed with the age that with God thus taking an active part in the world's progress, it was easy to believe in indefinite evolution 'onward and upward.' Some of the liberals flatly asserted that mans' body, like other physical forms had evolved from lower animals.1177/

This is also exemplified in the theological publications of Pierre Teilhard de Chardin*, who wrote:

> C. A NEW MYSTICAL ORIENTATION: THE LOVE OF EVOLUTION
>
> II. Reduced to the initial and still crude form in which it is now emerging in the modern world, the new religious

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1177. R. Cross*, The Emergence of Liberal Catholicism in America 149 (1958).

> spirit appears, as we have said (cf. I), as the impassioned vision and anticipation of some super-mankind. . . . To believe and to serve was not enough: we now find that it is becoming not only possible but imperative literally to love evolution.
>
> 12. Analyzed from the Christian point of view, as spontaneously and necessarily born from contact between faith in Christ and faith in the world, love of evolution is not a mere extension of love of God to one further object. It corresponds to a radical reinterpretation (one might almost say it emerges from a recasting of the notion of charity).1178/

1178. P. Teilhard de Chardin*, Christianity and Evolution 183-84 (R. Hague trans. 1971). Accord, id. at 85 ("Seen, however, on the panoramic screen of an evolutive world which we have just erected, the whole picture undergoes a most impressive change."); P. Teilhard de Chardin*, Science and Christ (1968); P. Tielhard de Chardin*, The Appearance of Man (1965); S. Jaki*, The Road of Science and the Ways to God 303 (1978)("If one adds to this Gabriel Marcel's consternation on hearing Teilhard de Chardin brush aside the extermination of millions in Soviet slave labor camps as a mere episode in a march toward a glorious future, one may grasp the extent to which evolutionism can act as an ethical blindfold."); H. Birx*, Pierre Teilhard de Chardin's Philosophy of Evolution _____ (1972); (1972); B. Delfgaauw*, Evolution: The Theory of Teilhard de Chardin (H. Hoskins trans. 1969).

Other examples of neo-Modernists incorporating evolution in their theology can be found in Hans Küng*, Bruce Vawter* (an ACLU witness in McLean), Karl Rahner*, John Mackenzie*, and others.1179/ Before neo-Modernism, a leading Modernist and leading evolutionist Catholic was St. George Mivart*, who was excommunicated.1180/ Similarly, Teilhard de Chardin was forbidden to publish or teach on philosophical subjects, suffered the banning of one book and the refusal to publish others, and was the subject of a Monitum issued by Pope John xxiii in 1962.1181/ Neo-Modernism, while accepted by only a minority of the Roman Catholic laity and clergy, is advocated by a majority of its

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1179. K. Rahner*, Hominisation (1965); A. Hulsbosch*, God's Creation: Sin and Redemption in an Evolving World (1965).

1180. J. Moore*, The Post-Darwinian Controversies 304 (1979).

1181. _____*, P. Teilhard de Chardin, _____ Encyclopaedia Britannica ____ (15th ed. 1974).

theological faculty in America.1182/

(v) Reform Judaism. Reform Judaism generally includes doctrinal belief in evolution (just as Orthodox Judaism embraces belief in creation).1183/ This is evident in the new Reform Jewish commentary on the Torah.1184/

1182. Institute for Education Affairs and Roper Center*, What Theologians Believe, This World, Summer 1982, at 27, 72 (60% of Catholic theological faculty describe themselves as "liberal").

1183. See L. Barish* & R. Barish*, Basic Jewish Beliefs 108-11 (1961); Schulman*, Statement of Principles for the Guidance of the Modern Jew, in 48 Central Conference of American Rabbis 421 (Isaac E. Marcuson ed, 1937).

1184. This commentary states:

> Ancient people considered the earth the center of the universe and natural law not as unalterable but as subservient to the will of God. This view is the basic principle underlying many stories, especially the opening chapters of the Book of Genesis which have become a formidable obstacle to the reading of the Bible. Why--it is asked--should we concern ourselves at all with stories of the six days of creation, with Adam and Eve, and the Garden of Eden? All these are unscien-

(vi) Buddhism and Hinduism. Buddhism holds to an evolutionary doctrine, in viewing the universe as always existing with developmental cycles while denying a divine creator.1185/ Hinduism also generally embraces evolution.1186/

(vii) Secular Humanism and Other Humanist Faiths. Secular Humanism and other

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tific, antiquated myths, and therefore appear to be irrelevant.

. . . .

The contemporary readers thus should restrain their inclination to do battle with or look for modern comparisons to ancient notions of creation.

. . . .

The Book of Genesis does not appear to tell of human growth and development in a way palatable to moderns, schooled in the principles of evolution.

W. Plaut*, The Torah: A Modern Commentary 6, 16 (1974).

1185. See K. Nakamura*, Buddhist Philosophy, in 3 Encyclopaedia Britannica: Macropaedia 425, 425 (15th ed. 1975).

1186. See Basham*, Hinduism, in 8 Encyclopaedia Britannica: Macropaedia 888, 889 (15th ed. 1975).

Humanist faiths generally include a doctrine of evolution. There are many varieties of Humanism, including "religious-humanism, ethical-humanism, scientific-humanism, evolutionary-humanism, and secular-humanism."1187/ Secular Humanism1188/ does indeed exist and,

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1187. Beattie*, Humanism: Secular or Religious, Free Inquiry, Winter 1980-81, at 11, 11. E.g., Lamont*, Naturalistic Humanism, Humanist, Sept.-Oct. 1971, at 9; Haydon*, Is Scientific Humanism Religious?, 2 Religious Humanism 49, __ (1968); De Ford*, Humanism and Atheism I, Humanist, July-Aug. 1971, at 5.

1188. Secular Humanism is defined in A Secular Humanist Declaration and Humanist Manifesto II, which many individuals signed. It is described by Fletcher* and others* in terms of its Atheism:

> This is because the quintessential description of humanism is negative. Its concern is with man, yes, of course, but definitively it does not have any place for God or the gods. The real significance of the aphorism of Protagoras of Abdera--that man is the measure of all things--is and always has been the universally understood implication: Man, not God is the measure of both reality and values.
>
> . . . .
>
> Once these features are pointed out, however, we can see that they

in fact, "American secular humanism is mani-

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could just as well be part of a religious world-view or a nonreligious one. What counts about humanism is the negative side, what it does not include or accept. That is, it does not accept the superhuman and the supernatural. Fletcher*, Secular Humanism: It's the Adjective that Counts, Free Inquiry, __ 1984, at ___. Accord, A Secular Humanist Declaration, Free Inquiry, Winter 1980-81, at 3, 5 ("6. Religious Skepticism. As secular humanists, we are generally skeptical about supernatural claims. . . . However, we find that traditional views of the existence of God either are meaningless, have not yet been demonstrated to be true, or are tyrannically exploitative. Secular humanists may be agnostics, atheists, rationalists, or skeptics, but they find insufficient evidence for the claim that some divine purpose exists for the universe."); Kurtz*, Humanism and Religion: A Reply to the Critics of Humanist Manifesto II, Humanist, Jan.-Feb. 1974, at 4, 5 ("Thus in answer to the question, can one believe in God and still be a humanist, we need to ask of the believer: What do you mean by 'God'? If it is still a transcendent divine being or reality who created man and influences and controls his destiny, then the answer is 'No,' for there is insufficient evidence. If, on the other hand, by 'God' one refers to the depth of human longing for a better life, and if by 'God' you allow man a choice, then the answer may be, for many humanists, 'Yes.'"); DeFord*, Humanism and Atheism I, Humanist, July-Aug., 1971, at 5, 5 ("humanism, in my

festing its potency in altering long-held doctrine and practice. . . ."1189/ It has been categorized as a religion by the U.S. Supreme Court as well as by many proponents,1190/ and it and other Humanist faiths

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viewpoint, must be atheistic or it is not humanism"); P. Kurtz*, In Defense of Secular Humanism (1983).

1189. Pfeffer*, Issues That Divide: The Triumph of Secular Humanism, ____ Journal of Church & State 203, 216 (1977). Accord, P. Kurtz*, In Defense of Secular Humanism (1983).

1190. The Supreme Court stated in Torcaso v. Watkins:

> Among religions in this country which do not teach what would generally be considered a belief in the existence of God are Buddhism, Taoism, Ethical Culture, Secular Humanism and others.

367 U.S. 488, 495 n.11 (1961). See Malnak v. Yogi, 440 F. Supp. 1284, 1326 n.29 (D. N.J. 1977), aff'd per curiam, 592 F.2d 197 (3d Cir. 1979).

Many proponents have categorized Secular Humanism and other Humanist faiths as secular religions. E.g., Kurtz*, Humanism and Religion: A Reply to the Critics of Humanist Manifesto II, Humanist, Jan.-Feb. 1974, at 4, 4 ("It is no secret that the issue of antitheism is a hotly contested one in the humanist movement. One point of view maintains that humanism is primarily a scientific, philosophical, or moral outlook

includes a doctrinal belief in evolu-

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and that it must decisively reject any religious trappings. Humanism should unabashedly defend atheism, agnosticism, or skepticism on intellectual and moral grounds. . . . Others hold the contrasting viewpoint that religious values are important in human experience, that humanism, under one interpretation, is itself a religion and that it ought to appreciate and be sensitive to humanist values within the religions, even the most orthodox ones."); Haydon*, Is Scientific Humanism Religious?, Religious Humanism, Spring 1968, at 49, 50-51 ("Others, more emancipated, will gladly salute Humanism as a religion, and they will be factually justified."); see Ramsey*, Religion, Philosophy of, 15 Encyclopaedia Britannica 592, 597-98 (15th ed. 1974)(discussing "secular religion"). The Humanist Counselor Directory of the American Humanist Association describes the following ministerial activities:

> As the legal equivalent of ministers, priests, or rabbis, Humanist Counselors, AHA, certified by the American Humanist Association, solemnize marriages and officiate at memorials, namings, and other rights of passage. Counselors also may act as chaplains on campuses and in prisons, hospitals, and other institutions where the presence of a nontraditional or nontheistic minister is often a need.
>
> Just as ministers are authorized to counsel those who come to them in personal difficulty, so are Humanist Counselors, AHA.

1980 Humanist Counselor Directory, Humanist, Nov.-Dec. 1980, at 48.

tion,1191/ as the following examples show.

Secular Humanism and other Humanist faiths are represented by Humanist Manifesto II, which emphasizes evolution in

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1191. DeFord*, Humanism and Atheism I, Humanist, July-Aug. 1971, at 5, 5 ("My own tentative general definition of humanism would be that it is a philosophical system based on the concept that the universe, life, and consequently mankind are the result of natural evolutionary processes alone, and hence that our view of them must be monistic."); Lamont*, Naturalistic Humanism, Humanist, Sept.-Oct. 1971, at 9, 9 ("Humanism believes, first, that Nature or the universe makes up the totality of existence and is completely self-operating according to natural law, with no need for God or gods to keep it functioning. . . . Second, Humanism holds that the race of man is the present culmination of a time-defying evolutionary process on this planet that has lasted billions of years . . .."); Saladin*, Getting Ahead By Getting Together: Symbiosis and Evolution, Humanist, Jan.-Feb. 1979, at 10, 11 ("Zillions of months ago, people were just little bits of amoebid ooze, crawling about on the ocean floor, eating up their equally primitive comrades in their lethargically barbaric way, leaving behind only their shoes and other indigestible remains."); Harneck*, Carl Sagan: Cosmic Evolution v. the Creationist Myth, 41 Humanist 5 (July-Aug. 1981).

such passages as that "science affirms that the human species is an emergence from natural evolutionary forces."1192/ This Manifesto was signed by "one hundred seventy Unitarian Universalist ministers," as well as twenty-nine American Ethical Union Ministers and many other Humanist clergy.1193/ These faiths are also represented by A Secular Humanist Declaration, which lists evolution as one of ten points and states that "the evolution of the species is supported so strongly by the weight of evidence that it is difficult to reject it . . . ."1194/

1192. Humanist, reprinted from Humanist Manifesto II, Humanist, Sept.-Oct. 1973, at 4.

1193. Wilson*, Pioneer of Evolutionary Humanism, Humanist, May-June 1975, at 40, 40; Humanist Manifesto II in Humanist manifestos I and II, at ___ (P. Kurtz ed. 1973).

1194. Kurtz*, A Secular Humanist Declaration, Free Inquiry, Winter 1980-81, at 3, 6. Its original signers include the President of the Fellowship of Religious Humanists. Id.

"Evolutionary Humanism as a Developed Religion" is the concluding chapter of a book of Sir Julian Huxley*,1195/ who described that religion elsewhere as follows:

> On the basis of our present understanding, all reality is in a perfectly valid sense one universal process of evolution. The single process occurs in three phases. . . .
>
> . . ..
>
> The new framework of ideas on which any new dominant religion will be based is at once evolutionary and humanist. For evolutionary humanism, gods are creations of man, not vice versa. . . .

1195. J. Huxley*, Religion without Revelation 203 (rev. ed. 1957). Sir Julian Huxley*, a prominent author on the subject of evolution, believed in a "religion of evolutionary humanism." Huxley*, The Coming New Religion of Humanism, Humanist, Jan.-Feb. 1962, at 3, 5. His religion was "not based on revelation in the supernatural sense, but on the revelations [of] science," id. at 5, that "all reality is in a perfectly valid sense one universal process of evolution." Id. at 4. He believed that "any Humanist ideology or religion must itself be an evolutionary system . . .." Huxley*, Evolutionary Humanism: Part I, Humanist, Sept.-Oct. 1952, at 201, 208.

> Evolutionary Humanism
>
> The beliefs of this religion of evolutionary humanism are not based on revelation in the supernatural sense, but on the revelations that science and learning have given us about man and the universe.1196/

Evolutionary Humanism, like Secular Humanism and other Humanist faiths, incorporates and stresses evolution as a doctrine.1197/

(viii) Nontheistic Religions. Other Non-

1196. Huxley*, The Coming New Religion of Humanism, Humanist, Jan.-Feb. 1962, at 3, 4, 5.

1197. Huxley*, Evolutionary Humanism: Part I, 12 Humanist 201, 206 (1952) ("What are the main elements which must be taken into account today in formulating a Humanist view of man's destiny, in expressing man's relations with the facts and problems of existence in a religious way, yet one which does not do violence to reasons and science or to our accumulated knowledge about the past? In the first place, I would put the facts and principles of evolution"); Huxley*, Evolutionary Humanism: Part II, 12 Humanist 249, 256 (1952) ("One of the articles of any Humanist creed must be this: that knowledge can be increased and that increase of knowledge is indespensable for anything that deserves to be called advance, whether in practice or in thought. . . . The comprehensive fact is that of evolution.").

theistic religions such as Scientology,1198/ Theosophy,1199/ and Anthroposophy1200/ similarly include evolutionist doctrines.

(ix) Atheism. Atheism generally holds to a doctrinal belief in evolution.1201/ Many leading evolutionists who were Atheists

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1198. L. Hubbard*, Scientology: A History of Man 22 (1965) ("The discovery of the GE makes it possible at last to vindicate the theory of evolution proposed by Darwin . . .."); L. Hubbard*, Dianetics 50 (2d ed. 1974) ("The proposition on which dianetics was originally entered was evolution.")

1199. H. Blavatsky*, The Key to Theosophy 65 (1889) ("No one creates [the universe]. Science would call the process evolution . . . ; we, Occultists and Theosophists, see in it the only universal and eternal reality . . .."); id. ("In short, our Deity is the eternal, incessantly evolving, not creating, builder of the universe . . .") (emphasis in original.).

1200. Anthroposophy, 8 Encyclopedia of Philosophy 13 (P. Edwards ed. 1967).

1201. E.g., Brown*, Stellar Evolution, Am. Atheist, Mar. 1982, at 21; Bock*, Some Thoughts on Evolution, Am. Atheist, Dec. 1981, at 4; Gurley*, Alternate Theories for Cosmology, Am. Atheist, Oct. 1980, at 13; Bozarth*, The Meaning of Evolution, Am. Atheist, Sept. 1978, at 19.

have been mentioned earlier.1202/ Although many Atheists do not regard their viewpoint as religious, it has been treated as religious along with any other secularistic world view for purposes of the establishment clause.1203/

Summary. Thus, there are many evolutionist religions, and they include Protestant, Catholic, Jewish, and non-Judeo-Christian faiths with widespread membership.

(b) Creationist Religions. Like evolutionist religions, creationist religions span the entire religious spectrum to include Protestant, Catholic, Jewish, and

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1202. Section 3[b](4)(i) supra.

1203. E.g., Malnak v. Yogi, 440 F. Supp. 1284, 1326 n.29 (D.N.J. 1977), aff'd per curiam, 592 F.2d 197 (3d Cir. 1979) ("Atheism may be a religion under the establishment clause in that the government cannot aid the propagation of a belief in the nonexistence of a supreme being. See Abington School District v. Schempp, [374 U.S. 203,] 225 [1963]; Zorach v. Clauson, 343 U.S. 306, 314 (1952).").

non-Judeo-Christian faiths. Creationist religions are not by any means limited to Fundamentalism, and the great majority of creationists are not Fundamentalists. Examples of creationist religions are:

Protestant:	(i)	Conservative Evangelical denominations; Fundamentalism; & other groups such as the Church of Christ, Seventh-day Adventists, most Mormons, Jehovah's Witnesses, etc.;
Catholic:	(ii)	Much Orthodox Roman Catholicism & Eastern Orthodoxy;
Jewish:	(iii)	Orthodox Judaism; and
Non-Judeo-Christian:	(iv)	Islam (Muslims), etc.

The American public splits almost evenly between religious faiths that are creationist and that are evolutionist. This is not an argument that creation-science is primarily supported by creationist religions, however, because it is instead supported by eighty-six percent of the

general public as indicated by scientific surveys, and by many people for nonreligious reasons as recognized by Raup*.1203a/

(i) Protestants. Creationists among Protestants are not restricted to Fundamentalists--and in fact the great majority of creationists are not Fundamentalists--but include Conservative Evangelicals such as many denominational groups of Presbyterians, Baptists, Methodists, Lutherans, Episcopalians, Pentecostals, and Bible churches, as well as many members within other denomina-

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1203a. Note 11 supra; Raup*, The Geological and Paleontological Arguments of Creationism, in Scientists Confront Creationism 147, 159 (L. Godfrey ed. 1983)("Increasinly, however, people without strong religious commitment are being drawn into and are expressing some acceptance of the arguments made by the scientific creationists. Therefore, control by an ideology may represent an argument in some quarters but certainly not in all. Furthermore, I think it can be argued that whether a body of reasoning is scientific or not should be decided independently of the question of whether the adherents are committed to one ideology or another.").

tional groups. Creationists also include the Churches of Christ and Seventh-day Adventists, and other groups such as Jehovah's Witnesses and most Mormons.1204/

(ii) Orthodox Roman Catholicism and Eastern Orthodoxy. In contrast to the neo-Modernist wing of Roman Catholicism, its Orthodox wing is generally or significantly creationist. Rev. Peter D. Fehlner, professor of dogmatic theology, at St. Anthony-on-Hudson Franciscan Seminary, has summarized

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1204. These denominational organizations are the Presbyterian Church in America and Reformed Presbyterian Church; Free Will Baptist Church and most Southern Baptist churches; Southern Methodist Church and Free Methodist Church; Missouri Synod, Wisconsin Evangelical Synod, and Orthodox Lutherans; Anglican Orthodox Church and other smaller Episcopal denominations; numerous Pentecostal denominations; Brethren, Christian and Missionary Alliance, Bible churches, and other nondenominational churches; Christian Reformed Church; etc. Note, Freedom of Religion and Science Instruction in Public Schools, 87 Yale L.J. 519-20 nn. 21-22 (citing sources).

Orthodox Roman Catholic doctrine on creation as follows:

> 1. Creation
> The teaching of the Church on origins reveals from her foundation a body of doctrine consistent and unvarying, not only as regards its general content and tenor, but the explicit formulation of its details as well.
>
> . . . .
>
> While the Church does not hold that God has revealed all that can be known about his creation, or of that which has been revealed that the precise sense has in every instance been definitively explained by the Church in the most explicit manner possible, certain points concerning the origin of the world and of the beings within it have been so revealed and definitively explained by the Church either solemnly or in her ordinary magisterium, in such ways that they may not be questioned or subjected to modification in view of further explications.
>
> (a) The whole world was created by God ex nihilo in the beginning of time.
>
> (b) The essential structure, or order of the world presupposed for any subsequent activity or development was established by God, and admits of no exceptions, except those directly produced by divine intervention, such as that which the Church claims will bring to pass the resurrection of the body from an inorganic to an organic state, and the new heavens and

earth at the end of time.

(c) The nature of the first man and first woman was made directly by God, by forming the male body out of pre-existing matter, the female body out of the body of the first man, by creating out of nothing a soul for each and then uniting soul to body as its form. . . .

(d) God made only one man and one woman in this fashion. All others find their origin in descent from these two, human procreation through conception accounting for the origin of the body, divine creation of each soul ex nihilo for the origin of the soul and its infusion into the body conceived. . . .1205/

He has similarly summarized Catholic doctrine on evolution:

4. Evolution

In the matter of origins the Church permits the proposal of theories of evolution as scientific explanations of the origin of the species (not of the world at all) in only a very restricted way, and on conditions reflecting what she otherwise knows to be the truth, in such ways that any

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1205. P. Fehlner, In the Beginning 30-31 (unpub. ms. 1983).

> such hypothesis only doubtfully merits the designation evolutionary. . . . Nor can the difficulty be avoided by a facile distinction claiming for science the task of solving the how of origins and for religion the 'who.' It is precisely because the Catholic faith claims to explain not only who did it, but how he did it--by creation, that we are able to distinguish the world as created from God as uncreated and infinite 1206/

Thomas Aquinas in his Summa Theologica taught a form of creation,1207/ as did the

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1206. Id. at 32. Accord, J. Johnson, The Crumbling Theory of Evolution 105-06 (19__) ("It is fundamental that we believe in Creation, out of nothing, of heaven and earth by one almighty personal God whose power now sustains His creation. (Fourth Lateran and First Vatican Councils). We may believe in evolution of the body (if convinced of it on the evidence) but not evolution of the soul; and, among the earthly race of man, polygenism is forbidden. (Humani Generis). Any idea of a god evolving with the universe was condemned by the First Vatican Council."); P. O'Connell*, The Origin and Early History of Man 9, 10, 11 (1965); Long, Evolutionism: A Fairy Tale for Adults, Friar Magazine, Oct. 1978, at 35; P. Haigh, What's Wrong with Evolution?, 4 (1975).

1207. Thomas Aquinas, 13 Summa Theologica: Man Made To God's Image 23 (E. Hill trans. 1964) ("REPLY: The original fashion-

Fourth Lateran Council, a magisterial statement by Pope Innocent III, the Council of Vienna, the Fifth Lateran Council, the Council of Trent, and Vatican I.1208/ The encyclical Humani Generis of Pope Pius XII, while allowing for belief in creation or

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ing of the human body can only have been done directly by God, not by means of any created forces. . . . God, however, although he is wholly immaterial, is nonetheless the only being who in his might can bring forth matter by creating it."); Thomas Aquinas, 15 Summa Theologica: World Order 161 (M. Charlesworth trans. 1970) ("Hence: 1. God is said to have ceased from work on the seventh day--not from all work (since it is said in John, My father works even until now) but rather from the creation of new genera and species which would not have already existed in God's first works. . . . 2. Certain things can be added daily to the perfection of the universe as regards individual things but not as regards species."); Thomas Aquinas, Summa Theologica, no. 2, q. XLV, at 221 (English Dominican Province trans. 1912) ("Therefore as the generation of a man is from the not-being which is not-man, so creation, which is the emanation of all being, is from the not-being which is nothing.").

1208. P. Fehlner, In the Beginning (unpub. ms. 1983).

some forms of theistic evolution, warned against "fictitious tenets of evolution" and exclusion of divine intervention in natural laws:

> 5. . . . Some imprudently and indiscreetly hold that evolution, which has not been fully proved even in the domain of natural sciences, explains the origin of all things, and audaciously support the monistic and pantheistic opinion that the world is in continual evolution. . . .
> 6. Such fictitious tenets of evolution which repudiate all that is absolute, firm and immutable, have paved the way for the new erroneous philosophy . . ..
> . . ..
> 36. For these reasons the Teaching Authority of the Church does not forbid that, in conformity with the present state of human sciences and sacred theology, research and discussions on the part of men experiences in both fields, take place with regard to the doctrine of evolution, in as far as it inquires into the origin of the human body as coming from pre-existent and living matter--for the Catholic faith obliges us to hold that souls are immediately created by God. However this must be done in such a way that the reasons for both opinions, that is, those favorable and those unfavorable to evolution, be weighed and judged with the necessary seriousness, moderation and measure, and provided that

> all are prepared to submit to the judgment of the Church to whom Christ has given the mission of interpreting authentically the Sacred Scriptures and of defending the dogmas of faith. Some however rashly transgress this liberty of discussion, when they act as if the origin of the human body from pre-existing and living matter were already completely certain and proved by the facts which have been discovered up to now 1209/

Pope Paul VI, in Credo of the People of God,

1209. Pope Pius XII, Humani Generis: Encyclical Letter of His Holiness Pope Pius XII 4, 16-17 (1950). It goes on to condemn polygenism. Id. at 17 ("When, however, there is question of another conjectural opinion, namely polygenism, the children of the Church by no means enjoy such liberty. For the faithful cannot embrace that opinion which maintains either than after Adam there existed on this earth true men who did not take their origin through natural generation from him as from the first parent of all, or that Adam represents a certain number of first parents."). Accord, Pope Pius XII, Man, in The Pope Speaks 17 (M. Chinigo ed. 1957) ("On the topmost rung of the ladder of the living, God placed man, endowed with a spiritual soul, to be the prince and sovereign of the animal kingdom. Manifold research in the fields of paleontology, biology, and morphology on various problems regarding the origin of man has not yet yielded anything positively clear and certain.").

similarly warned against views of human evolution that exclude divine intervention and creation of the soul.1210/ Several leading creationist scientists have been Roman Catholics.1211/ The following summary has

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1210. Pope Paul VI, Original Sin and Modern Science, in 11 The Pope Speaks (1966) ("Evolution The theory of evolution will not seem acceptable to you whenever it is not decisively in accord with the immediate creation of each and every human soul by God, and whenever it does not regard as decisively important for the fate of mankind the disobedience of Adam, the universal first parent.").

1211. These include Louis Pasteur, the famous microbiologist, in the mid 1800s; Gregor Mendel, the great geneticist, in the late 1800's; Paul Lemoine, president of the Geological Society of France, director of the Natural History Museum in Paris, and a major editor of the Encyclopedia Francaise (1937), in the early 1900s; W. R. Thompson, director of the Institute of Biological Control of Canada, in the mid 1900s; and G. Sermonti, director of the Institute of Genetics at University of Palermo and one of twelve lecturers at the recent Vatican seminar on evolution under the Pontifical Institute, at the present day. Section 3[d](2) infra; e.g., Thompson*, Introduction to C. Darwin*, The Origin of Species, at xxii-xxiii (1956); G. Sermonti & R. Fondi, Dopo Darwin: Critica all' Evoluzionismo (1980).

been given regarding balanced treatment of scientific views:

> But in the context of what is defined and proclaimed as a 'neutral' school, the exclusive presentation of evolution as the only plausible explanation of the cosmic and of human origins, or worse as a 'fact' beyond doubt, belies the religious neutrality of the school. Such a presentation does conflict directly with the teachings of the Church at many points, and it is tantamount to indoctrination of a religious kind, one judged by the Church to be false. Balanced treatment, viz. the presentation of arguments for an evolutionary theory and against it, for a creationist theory and against it is certainly fair and in no ways in conflict with the teaching of the Church.1212/

(iii) Orthodox Judaism. Orthodox Judaism is generally creationist. The Association of Orthodox Jewish Scientists published a book in which essays defend creation as consistent with the Torah,1213/ and

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1212. P. Fehlner, In the Beginning 32 (unpub. ms. 1983).

1213. E.g., Perlman, Science vs. Evolution?, in A Science and Torah Reader 28, 28 (Y. Komreich ed. 1970) ("The 'theory' of evolution lacks most of the characteris-

Orthodox Jews in Israel recently convened a Conference on Inquiries into Evolution and the Origin of Life.1214/ A forthcoming book on the Torah and science describes the Orthodox Jewish position as creationist as follows:

> Creation as described in the Torah, both written and oral, is not ruled out by the available facts, and moreover in some instances the evidence makes a better case for creation than

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tics of a scientific theory, and, in fact, leads to serious conceptual difficulties. Rather than being a scientific theory, evolution is a doctrine or conviction of many who use it as a justification for an atheistic or agnostic world outlook or philosophy. In fact, many of these people have more 'faith' in evolution than would be required of them in a religion."); Etkin, The Religious Meaning of Contemporary Science, in A Science and Torah Reader 30, 31 (Y. Komreich ed. 1970) ("And though the religions still survive , all, even Judaism, have become deeply penetrated by the attitudes and ideas generated by evolution. Their foundations have been gnawed away and the faith of the believer is now overcast with doubt.").

1214. Proceedings of the Conference on Inquiries into Evolution and the Origin of Life (_____ 1981).

it does for evolution.1215/

The Rabbinical Alliance of America joined the plaintiffs in defending balanced treatment of creation-science in Keith v. Louisiana Department of Education.1216/

(iv) Non-Judeo-Christian Faiths. Islam, one of the world's largest religions, is also creationist. 1217/

1215. L. Spetner, Evolution: An Analysis from the Torah Premises 1 (in preparation 1985). Accord, Radkowsky, The Faith of an Orthodox Jewish Scientist Revisited, in B' Or Ha' Torah 21, 28 (_____ ed. 198_) ("Our sages of old always indicated that the validity of Judaism depended first of all on the necessary existence of G-d to explain Creation, then on the direct involvement with and revelation of G-d to the Jewish people in the exodus from Egypt and the giving of the Torah on Sinai. . . . Fortunately we don't have to face the problem of trying to fit Evolution into Judaism because Evolution has no scientific basis whatever."); Schneersohn, A Letter On Science and Judaism, in Challenge: Torah Views on Science and Its Problems 142, 146-47 (A. Carmell & C. Domb eds. 1978).

1216. Amended Complaint at 1, No. 81-989B (M.D. La., filed Dec. 2, 1981).

1217. Rahman*, Islam, 9 Encyclopaedia Britannica 911, 912 (15th ed. 1975); R.

An important question is whether public school instruction in creation-science along with evolution would require inclusion of the multitude of religious doctrines of creationist religions or evolutionist religions. However, only scientific explanations of origins may be discussed in the science classroom in public schools, so none of these religious doctrines may be presented as science. Because creation-science and evolution are the sole scientific alternatives, as discussed above,1218/ only these two scientific explanations need or can be presented.

Conclusion. Creation-science and evolution are parallel in their consistency with various religions. There are numerous evolutionist religions, and the creationist

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Khalifa, Creation: Why We Must Teach It in Schools (1982).

1218. Section 2[f] supra.

religions are primarily nonfundamentalist. This consistency does not make either creation-science or evolution religious. This is a material factual issue.

(2) Non-Religious Nature of Other Parallels between Creation-Science and Evolution

Overview. Some parallels between creationist religions and creation-science, which are often erroneously alleged to make creation-science religious, are equally true of evolutionist religions and evolution. These are:

(a)	Original articulation in religious texts,
(b)	Some scientific proponents with strong religious beliefs or motivations,
(c)	Some scientific writers with other religious publications or activities,
(d)	Faith, and
(e)	Teleological aspects.

The following paragraphs show these characteristics to be equally true of evolution.

(a) Original Articulation in Religious Texts. Both general concepts, creation and evolution, were first articulated in religious writings, and at roughly the same time. Just as creationist concepts were first set forth in the Pentateuch and the Koran, evolutionist concepts were first presented in the "Babylonian Genesis" or Enuma Elish in roughly the same time period and in other ancient religious writings, with the universe existing eternally and life evolving from water.1219/ Both general concepts, creation and evolution, were first stated by religious leaders. Just as creation was first mentioned by Moses and Mohammed and other religious leaders, evolu-

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1219. L. Spence*, Myths and Legends of Babylonia and Assyria 84 (1916); see Jacobsen*, Enuma Elish--"The Babylonian Genesis", in Theories of the Universe 9, ___ (M. Munitz, ed. 1957); A. Heidel*, The Babylonian Genesis 88 (2d ed. 1951).

tion was first articulated in the religious-philosophical writings of such ancient Greeks as Thales, Anaximander, Anaximenes, Xenophanes, Heraclitus, the Milesian school,1220/ Empedocles, who "may justly be called the father of the evolution idea,"1221/ of the

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1220. H. Osborn*, From the Greeks to Darwin (2d ed. 1929) (generally); Dobzhansky*, Evolution 10 Encyclopedia Americana 734 (1976)(generally); Harrison*, Universe, Origin and Evolution of, in 18 Encyclopaedia Britannica 1007, 1007 (15th ed. 197_) (Milesian and Pythagorean schools); Guthrie*, Anaximander, in 1 Encyclopaedia Britannica 885, 885 (14th ed. 1960) (Anaximander).

1221. H. Osborn*, From the Greeks to Darwin 52 (2d ed. 1929). Accord, W. Stansfield*, The Science of Evolution 26 (1977) ("Although most of his biological concepts were primitive, in at least one of them he approached very closely the modern view: (1) higher forms of life gradually evolve, (2) plants evolved before animals, and (3) better adapted forms tend to replace the less adapted ones."); R. Lull*, Organic Evolution 6 (rev. ed. 1948) ("Empedocles may be called the father of evolution."); B. Fuller*, History of Greek Philosophy: Thales to Democritus 195 (1923) (Empedocles described "a true Darwinian evolution, the direction of which is explained entirely by chance, by the struggle for life, and by

Roman Lucretius, and the ancient Chinese,1222/ as well as in the earlier religious writing of the priestly Babylonian author of the Enuma Elish. Because these ancient religious concepts are merely consistent with evolution and creation-science, this common historical background does not make either religious. This is a material factual issue.

(b) Scientific Proponents with Strong Religious Beliefs or Motivation. Philosophers have long treated the source or inspiration of a concept as irrelevant to its objective merit.1223/ Raup*, a paleontolo-

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the survival of the fittest"); E. Zeller*, Outlines of the History of Greek Philosophy 75 (13th ed. 1960); Peck*, Empedocles, in 8 Encyclopaedia Britannica 400, 400 (14th ed. 1960).

1222. Lucretius*, The Nature of the Universe 58 (R. Latham trans. 1951); Veith*, Creation and Evolution in the Far East, in 3 Issues in Evolution: Evolution after Darwin 1, 2, 7 (S. Tax & C. Callender eds. 1960).

1223. Ruse*, A Philosopher at the Monkey Trial, 93 New Scientist 317, 318

gist at the Field Museum of Natural History, has acknowledged the corollary that "whether a body of reasoning is scientific or not should be decided independently of the question of whether the adherents are committed to one ideology or another."1224/ Both creation-science and evolution are supported by some scientists who hold strong religious convictions and who sometimes are motivated or inspired by those religious beliefs.

(i) Strong Religious Beliefs. Strong personal religious beliefs--which many di-

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(1982). See Laudan*, Commentary: Science at the Bar--Causes for Concern, 7 Science, Technology and Human Values 16, 17 (1982).

1224. D. Raup*, The Geological and Paleontological Arguments of Creationism, in Scientists Confront Creationism 147, 159 (L. Godfrey ed. 1983). See also Brief of Defendants* at 54, Keith v. Louisiana Department of Education, No. 81-989B (M.D. La. filed Dec. 2, 1981) ("133. Although the inspiration for formulating a scientific theory may come from any source, in order to be scientific the theory must meet all the criteria of science.").

verse people have--do not necessarily make everything that the individual does or thinks to be religiously motivated and biased. To give literary examples, Nathaniel Hawthorne and Lewis Wallace were Christians who were inspired by strong religious beliefs and reflected them in their literary works, but that does not render The Scarlet Letter or Ben Hur inherently religious or exclude them from the literature classroom.1225/ Charles Darwin himself was professionally trained as a theologian rather than as a scientist, and ultimately held an "agnosticism tending at times toward atheism,"1226/ but that does not render his

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1225. "Vonnegut's intent to give religious comments did not render assignment of Slaughterhouse-Five an establishment of religion." Todd v. Rochester Community Schools, 41 Mich. App. 320, 200 N.W.2d 90 (1972).

1226. J. Moore*, The Post-Darwinian Controversies 315 (1979). Accord, note ___ supra. Other Agnostic and Atheistic evolu-

books inherently religious or exclude his scientific discoveries from the classroom. Stansfield* and some other evolutionists hold a theistic evolutionary position, that God "create[d] gradually through an evolutionary process,"1227/ but that religious

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tionists are discussed in Section 3[b](4)(a) supra.

1227. W. Stansfield*, The Science of Evolution 578 (1977) ("Today there is still a sizable group preaching that one cannot embrace the theory of evolution and at the same time believe in a Deity. In the author's opinion, this attitude does not help people to cope with the real world and harmonize the findings of modern science with religion. . . . If there be any conflict between religion and science, it would seem to reside in the minds of those whose concept of their Deity is too limited to allow Him the power to create gradually through an evolutionary process. If God is God, then He can do as He wishes with His universe; He could have brought all living things into being instantaneously, or He could have unfolded His creativity through the geological ages according to 'natural laws.' And what is the source of these natural laws? To those who believe in a Deity, they are part of the way that He sustains His creation."). Other theistic evolutionists are described in Sections 3[b](4)(a) and 3[c](1)(a)(ii)-(iv) supra.

belief does not make his textbook and other scientific writings religious and inappropriate for the public school classroom. The mere consistency of the personal religious convictions of either evolutionist or creationist authors with their textbook works obviously does not render the books inherently religious, and the religious motive in writing one book obviously does not necessarily carry over into every other book or conclusion.

(ii) Religious Inspiration or Source. The inspiration or source of a scientific discovery or explanation is similarly irrelevant to the objective merit and scientific validity of that scientific discovery or explanation.1228/ For example, medicine arose from occultism and chemistry arose from mystical alchemy.1229/ Kepler,

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1228. Notes 1223-24 supra.

"in searching for his laws of planetary motion, was motivated by Pythagorean mysticism."1230/ Mendeleev, in formulating the periodic system of the elements, had a "pantheistic mystical longing to see a Chain of Being ramify through the chemical facts" as his inspiration.1231/ A vision of a snake biting its tail was the inspiration for Kekule's development of the model for the benzene molecule, while a vision on reading a pantheistic poet was the inspiration for Tesla's discovery of the alternating current motor.1232/ A religious prophetess, the

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1229. H. Haggard*, Mystery, Magic, and Medicine (1933); A. Ihde*, The Development of Modern Chemistry 10-18 (1964).

1230. Smart*, Religion and Science, 7 Encyclopedia of Philosophy 158, 159 (P. Edwards ed. 1967).

1231. Feuer*, Teleological Principles in Science, 21 Inquiry 377, 381 (1978).

1232. Kekule*, 7 Dictionary of Scientific Biography, 281 (C. Gillispie ed. 1973); J. O'Neill*, Prodigal Genius: Life of Nicola Tesla (19___); see generally Geisler, Is "Creation-Science" Science or

Oracle of Delphi, was the inspiration for Socrates' philosophy and literature, while three dreams were the inspiration for Rene Descartes' philosophy of rationalism.1233/ The merit of an idea in any discipline is independent of its source.

(iii) Religious Motive of Purpose. The motive or purpose of a scientist is also irrelevant to the objective validity of the scientist's conclusions. Sir Francis Bacon, the father of the scientific method, had as his purpose in scientific studies to "subdue the world" according to the command in Genesis and urged others to "[s]tudy the Heaven and the Earth" to see the creator's handiwork.1234/ Sir Isaac Newton was moti-

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Religion?, Journal of the American Scientific Affiliation, __ 1982, at 8.

1233. Plato, Apology in The Collected Dialogues of Plato 6-9 (E. Hamilton & H. Cairus eds. 1964); J. Maritain*, The Dream of Descartes 14 (trans. M. Anderson 1944).

vated to study science by a biblical prophecy in the book of Daniel, and wrote commentaries on parts of the Bible as well as in defense of the 6000-year chronology of Archbishop Ussher.1235/ Boyle was inspired to study nature by his perception of God's

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1234. F. Bacon, 1 Novuum Organum cxxix (_____); F. Bacon, Refutation of Philosophies ___ (1608) ("[God] did not give you reliable and trustworthy sense in order that you might study the writings of a few men. Study the Heaven and the Earth, the works of God himself, and do so while celebrating His praises and singing hymns to your Creator.").

1235. I. Newton, Observations upon the Prophecies of Daniel, and The Apocalypse of St. John 248-49 (B. Smith ed. 1733) ("[I]n the very end, the Prophecy [of Daniel and John] should be so far interpreted as to convince many. Then, saith Daniel, many shall run to and fro, and knowledge shall be increased. . . . 'Tis therefore a part of this Prophecy, that it should not be understood before the last age of the world; and therefore it makes for the credit of the Prophecy, that it is not yet understood. But if the last age, the age of opening these things, be now approaching, as by the great successes of late Interpreters it seems to be, we have more encouragement than ever to look into these things."); G. Christianson*, In the Presence of the Cre-

works. 1236/ In fact, modern science arose from a theistic and creationist basis.1237/ Pasteur was a creationist Roman Catholic who vigorously opposed evolution on religious as well as scientific grounds. On the other side, T. H. Huxley*, Haeckel*, and many other Darwinian spokesmen were

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ator: Isaac Newton and His Times (1984).

1236. Boyle, Some Motives and Incentives to the Love of God, in I Works of Robert Boyle 167 (1744). Another example is Maury, superintendent of the U.S. National Observatory. R. Numbers*, Creation by Natural Law 88 (1977) (Maury wrote: "[T]hat rule is never to forget who is the author of the great volume which nature spreads out before us, and always to remember that the same Being is also the author of the Book which Revelation holds up to us; and though the two worlds are entirely different their records are equally true, and when they bear upon the same point, as now and then they do, it is as impossible that they should contradict each other, as it is that either should contradict itself. If the two cannot be reconciled, the fault is ours, and because in our blindness and weakness we have not been able to interpret aright, either the one or the other or both.").

1237. Section 3[b](4)(d) supra.

Agnostics or Atheists motivated by an antipathy toward Christianity and a desire to disprove the Bible.1238/ In an analogous field, the eminent archaeologists Albright (of Johns Hopkins) and Glueck (of Hebrew Union College) were motivated in their archaeological work by a desire to confirm the Bible, and have used the Bible as their primary guide to possible sites for excavations, as have countless other archaeologists.1239/

These points are important because the

1238. Section 3[B](4)(g) supra.

1239. N. Glueck, Rivers in the Desert 30 (1959) ("Our methods and techniques of penetrating its secrets were the same as those we had used in our archeological mapping of all of Transjordan and the Jordan Valley. They had been perfected in modern times especially by William F. Albright. The first task was to assemble and examine the literary evidence. The chief source of information was the Bible itself. Its historical memories and descriptions and sometimes exact references to particular places are of inestimable value to the scholar.").

ACLU in this case,1240/ and many leading evolutionists,1241/ have employed the strategy of an ad hominem attack on creation-science by identifying a creationist scientist, pointing out his personal religious faith or writings, and erroneously arguing that creation-science is thereby religious. The same could be done with evolutionist scientists and their religious faith or writings, but it would be just as indefensible. Because the religious beliefs and motivations of proponents are not relevant

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1240. Brief of Defendants* at ____, Keith v. Louisiana Department of Education, No. 81-989B (M.D. La., filed Dec. 2, 1981).

1241. E.g., P. Kitcher*, Abusing Science: The Case Against Creationism (1982) (1982); Crawford*, Science as an Apologetic Tool for Biblical Literalists, in Creationism, Science, and the Law: The Arkansas Case 104 (M. LaFollette ed. 1983); Ruse*, Creation-Science Is Not Science, in id. at 150; M. Ruse*, Darwinism Defended 285-302, 322-24 (1982); N. Eldredge*, The Monkey Business: A Scientist Looks at Creationism (1982).

to the objective merit of their scientific explanations and conclusions, this parallel betwen evolution and creation-science does not make either religious. This is a material factual issue.

(c) Scientific Writers with Other Religious Publications or Activities. Both evolution and creation-science are advocated by scientific authors who have written theological treatises. Sir Julian Huxley* and many other evolutionists have authored religious treatises as well as scientific books,1242/ but this does not make their scientific works inherently religious or impermissible for public school use. Isaac Asimov* has written both religious and scientific books,1243/ but his scientific ones

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1242. Compare J. Huxley*, Evolution in Action (1953) (scientific) with J. Huxley*, Religion without Revelation 203 (rev. ed. 1957) (religious) and note 1196 supra.

1243. Compare I. Asimov*, Asimov on Physics (1976) (scientific) and I. Asimov*,

are proper for the classroom. The religious publications of either evolutionist or creationist scientists do not deprive the authors of their status as scientists and do not deprive their scientific works of their scientific character. This point is very important because the ACLU brief in Keith selects a creationist scientist who has written religious books, quotes from such a book that does not purport to describe creation-science, and erroneously concludes that that is what creation-science is.1244/ This is a material factual issue.

(d) Faith. Both evolution and creation-science are supported by some scien-

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Asimov's Guide to Science (rev. ed. 1972) (scientific) with I. Asimov*, In the Beginning: Science Faces God in the Book of Genesis 1-66 (1981) (religious) and I. Asimov*, Asimov's Guide to the Bible 9-13, 15-32 (1968) (religious).

1244. Brief of Defendants* at ____, Keith v. Louisiana Department of Education, No. 81-989B (M.D. La., filed Dec. 2, 1981).

tists who manifest faith in some ways, as Mathews observed in his introduction to the 1971 edition of The Origin of Species:

> The fact of evolution is the backbone of biology, and biology is thus in the peculiar position of being a science founded on an unproved theory--is it then a science or a faith? Belief in the theory of evolution is thus exactly parallel to belief in special creation--both are concepts which believers know to be true but neither, up to the present has been capable of proof.1245/

Because of the lack of evidence, Patterson* refers to evolution as based on "faith":

> I think many people in this room would acknowledge that during the last few years, if you had thought about it at all, you have experienced a shift from evolution as knowledge to evolution as faith.1246/

1245. Mathews*, Introduction to C. Darwin's The Origin of Species xi (1971). Accord, Leith*, Are the Reports of Darwin's Death Exaggerated?, 166 The Listener 390, 392 (1981) ("Just as preDarwinian biology was carried out by people whose faith was in the Creator and His plan, post-Darwinian biology is being carried out by people whose faith is in, almost, the deity of Darwin.").

1246. Address of Dr. Colin Patterson*, American Museum of Natural History, tr. at

The same has been said about biochemical evolution[1247] and "faith in science" as a "re-

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4 (Nov. 5, 1981). Accord, Scott*, Presidential Address, 108 Nature Sept. 29, 1921 at 153 ("Is even then evolution not a scientifically ascertained fact? No! We must hold it as an act of faith because there is no alternative."); W. Bateson*, The Limitations of Science 200 (1933) ("We have the impression that it is only by extraordinary acts of faith that biologists can suppose that the actual progress of life can be explained in the terms they adopt."); J. Rifkin*, Algeny 119 (1983) ("[E]volution must be a matter of personal faith. About the best that can be said about the theory is that it represents a belief that many people share about how life developed, a belief that can be neither proved nor disproved. Of course, everyone is entitled to his own beliefs, speculations, and personal convictions, but evolution proponents profess that their theory represents much more than a simple article of faith. It is pure truth, they contend, even though unprovable, and in their zeal they are unwilling to brook any opposition to its central tenets.").

1247. Yockey*, A Calculation of the Probability of Spontaneous Biogenesis by Information Theory, 67 Journal of Theoretical Biology 377, 377 (1977)("It is concluded that belief in currently accepted scenarios of spontaneous biogenesis is based on faith, contrary to conventional wisdom.); G. Kerkut*, Implications of Evolution 150 (1960) ("There is, however, little evidence in favour of biogenesis and as yet we have

ligion" generally.1248/ Again, evolution and creation-science are parallel.

(e) Teleological Aspects. Both crea-

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no indication that it can be performed. There are many schemes by which biogenesis could have occurred but these are still suggestive schemes and nothing more. They may indicate experiments that can be performed, but they tell us nothing about what actually happened some 1,000 million years ago. It is therefore a matter of faith on the part of the biologist that biogenesis did occur and he can choose whatever method of biogenesis happens to suit him personally; the evidence for what did happen is not available.").

1248. J. Greene*, Science, Ideology, and World View 177 (1981) ("In both cases science was only a tool, a weapon, in defense of positions that were essentially religious and philosophical. Faith in science can be no less a religion than faith in God."); Hammond*, The Value System in the Scientific Subculture, 32 Bulletin of the Atomic Scientists 10, 36-40 ("To many scientists, pure science has become the new religion. We have developed our own mystique; we have dogma, ritual, a high priesthood, a system for training young priests of science and a reverence for science that rivals my grandmother's reverence for her personal deity. I have real fear that blind belief in the majesty of established science may reduce it to a role as ineffective as that of the churches that it has supplanted.").

tion-science and evolution have teleological (or design) aspects. Just as creation-science mentions the complex order in nature as evidence of creation, evolution often involves teleology in the form of natural selection and adaptation.1249/ Teleology is not an inherently religious concept;1250/ and in fact "[t]eleological principles are essential to the functioning of sciences

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1249. Grene*, _____, in Toward a Theoretical Biology 61 (C. Waddington ed. 1969)("adaptation, like its Victorian twin 'utility,' is itself a teleological concept; it is adjustment to something for some end."); T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 502 (1977)("The process of natural selection is teleological but only in the sense of indeterminate natural teleology."); Ayala*, Teleological Explanations in Evolutionary Biology, Philosophy of Science, Mar. 1970 at 1-2 ("One of his greatest accomplishments was to bring the teleological aspects of nature into the realm of science. He substituted a scientific teleology for a theological one.").

1250. Leslie*, Anthropic Principle, World Ensemble, Design, 19 American Philosophical Quarterly 141, 141 (1982)("But let us first be clear that calling it evidence

. . .."1251/ The "scientific method does not allow us to exclude data which lead to the conclusion that the universe, life and man are based on design," as von Braun observed.1252/ This is a material factual

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of Design (rather than of a World Ensemble) does not always indicate belief in a Designer. God might be not a Person but a creative force: our world of life may through its own nature have requiredness which is creatively effective. This can be defended independently of any religion."); Feuer*, Teleological Principles in Science, 21 Inquiry 377 (1978); see Leslie*, Cosmology, Probabilty, and the Need to Explain Life, in Scientific Explanation and Understanding 53, 54 (N. Rescher ed. 1983) (teleological argument about universe.).

1251. Feuer*, Teleological Principles in Science, 21 Inquiry 377, 377 (1978). Accord, Ayala*, Teleological Explanations in Evolutionary Biology, Philosophy of Science, Mar. 1970, at 1, 1 ("teleological explanations in biology are not only acceptable but indeed indispensable"); see T. Dobzhansky*, F. Ayala*, G. Stebbins* & J. Valentine*, Evolution 95-96 (1977) ("Purposefulness, or teleology, does not exist in nonliving nature. It is universal in the living world. . . . Living beings have an internal, or natural, teleology.").

1252. Letter from Dr. Wernher von Braun to Dr. Vernon Grose (Sept. 14, 1972) (creationist).

issue.

Conclusion. Evolution and creation-science are equally consistent with various religions. Just as evolution is consistent with various Protestant, Catholic, Jewish, and non-Judeo-Christian religions, the religions with which creation-science is consistent include not just Fundamentalist but other Protestant, Catholic, Jewish, and non-Judeo-Christian faiths. Evolution and creation-science are also parallel in being advocated by some scientific writers with strong religious beliefs and religious publications, and in being consistent with (although different from) religious texts written by religious leaders. These are material factual issues.

4. MATERIAL FACTUAL ISSUES THAT BALANCED TREATMENT OF CREATION-SCIENCE IS AT LEAST AS EDUCATIONALLY MERITORIOUS AS EXCLUSIVE INSTRUCTION IN EVOLUTION

> For God's sake let the children have their minds kept open--close no doors to their knowledge; shut no door from them.
>
> --Clarence Darrow,
> during the Scopes trial 1400/

Summary. Balanced public school instruction in creation-science along with evolution is at least as educationally meritorious as exclusive instruction in evolution. Prior sections have demonstrated that creation-science is as scientific and as nonreligious as evolution. In focusing on educational merit, the educational merit of alternative explanations is treated in Section [a]. The educational merit of balanced

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1400. The World's Most Famous Court Trial 187 (3d ed. 1925) (transcript of Scopes trial).

treatment of the alternative explanations of creation-science and evolution is discussed in Section [b]. If a third scientific view existed, it too could be taught as an alternative explanation, and the Louisiana statute would not restrict that. The current situation in Louisiana public schools, with exclusive instruction in evolution and exclusion of creation-science, is addressed in Section [c]. Finally, the significant discrimination against creationist scientists by schools and science publications is considered in Section [d]. These are material factual issues.

a. Material Factual Issue that Public School Presentation of Contrasting Explanations Has at Least the Educational Merit of Other Approaches

(1) Educational Merit of Alternative Explanations

Overview. Educational theory supports the merit of presenting alternative explanations--"teaching by contrast"--as summarized in Section (1). Education practice also supports it, both in science and in other fields, where Louisiana schools currently offer alternative explanations on other topics, as discussed in Section (2). These are material factual issues.

The presentation of alternative explanations on a nonreligious topic--"the common device of teaching by comparison and contrast"1401/--is an approach with great edu-

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1401. Anderson* & Kilbourn*, Creation, Evolution, and Curriculum, 67 Science Edu-

cational merit that is strongly supported by educational theory. This "comparative analysis" is stressed as the first of twenty-two instructional considerations in curriculum development, by Wiles* and Bondi*:

> 1. COMPARATIVE ANALYSIS--A thought process, structured by the teacher, that employs the description, classification, and analysis of more than one system, group, or the like in order to ascertain and evaluate similarities and differences.1402/

A "number of solutions" are important in teaching students to think, according to Tyler*:

> There is evidence to show that help given at this point in learning is

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Education 45, 53-54 (1983). Accord, J. Bergman, Teaching About the Creation/Evolution Controversy 42 (1979) ("teaching by contrasts is an effective way to present information and concepts.").

1402. J. Wiles* & J. Bondi*, Curriculum Development: A Guide to Practice 171, 172 (1972).

productive of improved problem solving. It is helpful to show students a number of solutions or a number of possible facts and conditions that have to be considered and to have them practice suggesting various possibilities when they are attacking problems.1403/

1403. R. Tyler*, Basic Principles of Curriculum and Instruction 71 (1969). A simila r argument for teaching "differing points of view" has been published in the education honorary society's monograph series by educational psychologist Bergman (a creationist):

> The essential point is that we must honestly deal with differing points of view, regardless of our own, and regardless of the prevailing point of view. Because a small number of people accept a point of view does not necessarily make it either correct or incorrect. Our concern is, should students be aware of, or at least exposed to, differing points of view, even if they are held by a minority? The limitations of time may force a teacher to spend less time on some theories, but even if there are a number of opposing minority theories, some exposure should be given to each.
>
> In teaching it is important that ideas not be forced on the student. Many concepts in science can be supported by a tremendous amount of evidence and are accepted by virtually all researchers in the field, but nonetheless, they are still ideas and can be wrong. Establishing teacher credi-

Alternative explanations implement the "interpretation questions" ("to compare certain ideas") and "evaluation questions" that are two of seven categories in Sanders'* taxonomy of questions.1404/ The underlying reason for alternative explantions is the de-

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> bility requires presenting material in nondogmatic ways according to the merits of the facts. Ideally, the evidence, both pro and con, should be presented for both sides. Information presented in a forceful, logical, coherent manner will be accepted by students. On the other hand, when information is forced on a student, the student either reacts against it or accepts it without full understanding. Information presented in a dogmatic way is learned without any strong foundation. In essence the student has learned what but not why.

G. Bergman, Teaching About the Creation/Evolution Controversy 32 (1979).

1404. N. Sanders*, _____; J. Wiles* & J. Bondi*, Curriculum Development: A Guide to Practice 314 (1972). The same is true of "divergent questions," which give "the student a choice between more than one alternative," in the questioning techniques recommended by Gallagher* and Aschner*. J. Wiles* & J. Bondi*, supra at 316-17.

termination to consider all relevant information on a subject, which philosopher of science Whitehead* stresses as critical to true science:

> An unflinching determination to take the whole evidence into account is the only method of preservation against the fluctuating extremes of fashionable opinion. This advice seems so easy, and is in fact so difficult to follow.1405/

The educational benefits of presenting alternative explanations are better development of process skills of science including analytic thinking, greater student interest and class participation, better education

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1405. A. Whitehead*, Science and the Modern World 187 (1925). Accord, C. Patterson*, Evolution 147 (1978)("But the essence of scientific method is not testing a single theory to destruction; it is testing two (or more) rival theories, like Newton's and Einstein's, and accepting the one that passes more or stricter tests until a better theory turns up. So we must look at evolution theory and natural selection theory in terms of their performance against their competitors.").

of the student in different viewpoints, and greater respect for diverse parental viewpoints. The function of public schools in controversial subjects is to teach students how to think, not what to think.

The benefit of studying minority scientific viewpoints has been discussed above, with Kerkut* calling it "a good principle to encourage the study of 'scientific heresies'" to prevent the "mental strait-jacket" of dogmatism.1406/ All prevailing scientific theories were once minority view-

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1406. G. Kerkut*, Implications of Evolution 157 (1960); Section 2[d](4) supra. Accord, Feyerabend*, The Expert as Con Man, Science Digest, Feb. 1984, at 83, 83 ("There are, of course, areas in which scientists agree--but this cannot raise our confidence. Unity is often the result of a political decision. On other occassions, it is the result of shared prejudices. Or it may indicate a decrease in critical consciousness; criticism remains faint if only one point of view is considered."); 1 I. Lakatos*, The Methodology of Scientific Research Programmes 1 (J. Worrall & G. Currie eds. 1978) ("Indeed, the hallmark

points, and over the history of science most majority viewpoints have been later abandoned. The critical point is that a minority viewpoint, to the extent it consists of relevant and additional scientific information and is advocated by members of the scientific community may and usually should be taught.

(2) Public School Examples of Present Alternative Explanations

Public schools currently teach alternate viewpoints on a variety of topics in most science and other subject disciplines. (i) In biology, public schools generally present both Mendel's genetic theory and Lamarck's hypothesis of inheritance of acquired characteristics,1407/ and are be-

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of scientific behaviour is a certain skepticism even towards one's most cherished theories. Blind commitment to a theory is not an intellectual virtue: it is an intellectual crime.").

1407. Describing Lamarckism is not just a historical comparison, because La-

ginning to cover the punctuated equilibrium approach as well as the neo-Darwinian synthesis, and generally give alternative explanations for the mass extinction of the dinosaurs and other organisms.1408/ (ii) In chemistry, public schools generally teach the molecular orbital theory along with the covalent bonding theory of chemical bonding,1409/ and the unit membrane model and

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marckians still exist as a minority viewpoint. E.g., M. Wolsky* & A. Wolsky*, The Mechanism of Evolution: A New Look at Old Ideas (1976); E. Steele*, Somatic Selection and Adaptive Evolution: On the Inheritance of Acquired Characters (2d. ed. 1981).

1408. E.g., S. Luria*, S. Gould* & S. Singer*, A View of Life 653-54 (1981) (Permian extinction). Other examples of alternative explanations in Gould's* college textbook are dual explanations for the Cambrian explosion, id. at 651-52; alternative approaches to taxonomy (pheneticist, cladistic, and classical evolutionary), id. at 684; multiple approaches to the number of kingdoms, id. at 693-94; dual views on whether life arose once or several times, id. at 711; and dual approaches on the origin of multicellular life, id. at 712.

1409. R. Hulsizer* & D. Lazarus*, The World of Physics 295-304 (1977); A. Green-

the fluid mosaic model of cell membrane structure. (iii) In physics, public schools generally offer the inflationary universe hypothesis or the steady state hypothesis along with the big bang hypothesis of the origin of the universe,1410/ and the particle theory as well as the wave theory of light.1411/ (iv) In earth science, public schools ordinarily present continental drift and alternative viewpoints, and several explanations of the origin of the moon. (v) In astronomy, public school classes gen-

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stone* & S. Harris*, Concepts in Chemistry 92-102 (3d ed. 1975).

1410. W. Stansfield*, The Science of Evolution 53 (1977) ("Two major hypotheses are currently popular in the explanation for evolution of matter in the universe: (1) the 'big-bang' hypothesis and (2) the 'steady-state' hypothesis."); J. Silk*, The Big Bang 316 (1979) ("alternative theories to the Big Bang").

1411. J. Murphy*, Physics: Principles and Problems 267-69 (1982); R. Hulsizer* & D. Lazarus*, The World of Physics 474-87 (1977).

erally discuss the open universe viewpoint as well as the closed universe viewpoint.

(vi) In economics classes, public schools frequently present Keynesian economic views along with Monetarist or free market economic views. (vii) In American history, public schools often offer conflicting viewpoints on the Vietnam War, and historical revisionist views as well as traditional views. (viii) In world history, public schools frequently discuss alternative explanations for the decline of the Roman Empire, and both Protestant and Roman Catholic viewpoints of the Reformation. (ix) In reading, public schools frequently employ both the look-say method and the phonics method. (x) In mathematics, public schools often use both "new math" approaches and traditional memorization approaches.

Conclusion. Thus, educational theory supports the presentation of alternative

explanations, and many existing public school classes offer various alternative explanations. This is a material factual issue.

b. Material Factual Issue that Balanced Treatment of Creation-Science with Evolution Has at Least the Educational Merit of Exclusive Instruction in Evolution

Overview. Public school instruction in creation-science along with evolution, because it amounts to presentation of alternative explanations, has educational merit, as Section (1) shows. Many noncreationist scientists and educators have publicly acknowledged the educational merit of balanced treatment. Balanced treatment is educationally feasible, and partial presentation of creation currently appears in one major textbook produced by a national secular publisher, as Section (2) points out. Balanced treatment clearly provides more, not less, information to the student, and

at the same time ends exclusive instruction in one scientific viewpoint (evolution) and exclusion of another scientific viewpoint (creation-science). If a third scientific viewpoint arose, it too could be taught as an alternative explanation under the Louisiana law. These are material factual issues.

(1) Educational Merit of Balanced Treatment as Presentation of Alternative Scientific Explanations

The educational merit of balanced treatment of creation-science and evolution has been acknowledged in print by many non-creationist evolutionist scientists and educators who support balanced treatment. They include prominent historian of science Provine* at Cornell, biology and science education professor Thompson* at University of Missouri, biologists Solomon* and Alexander*, education professors Anderson* at

East York Collegiate Institute and Kilbourn* at Ontario Institute for Studies in Education, one major public school textbook produced by a secular national publisher, and biochemist Morrow* at Wofford College. In fact, Darwin* himself argued for the educational merit of balanced treatment:

> I hope in a future work to do this. For I am well aware that scarcely a single point is discussed in this volume on which facts cannot be adduced, often apparently leading to conclusions directly opposite to those at which I have arrived. A fair result can be obtained only by fully stating and balancing the facts and arguments on both sides of each question; and this is here impossible.1412/

Provine*, the co-editor of The Evolutionary Synthesis (1980), acknowledges the merit of teaching "creationism . . . along with evolutionism," and regards "creationism" as "a viable, understandable and plaus-

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1412. C. Darwin*, The Origin of Species 6 (R. Hutchins ed. 1952).

ible theory" (although he views it as wrong):

> First of all I said that creationism should be taught along with evolutionism in grade schools and high schools. My motivation for wishing them to be discussed in this way is twofold. First of all I believe strongly in an open discussion of ideas. I do not believe that natural scientists should suppress the creationist point of view and keep it out of the science classroom when creationism is a viable, understandable and plausible theory for the creation point. It is my opinion that it is a wrong theory, and the reason why I would like it discussed, particularly in the science classroom, is that when we put it against evolutionism in the science classroom, creationism will gradually die out. Students will accept evoutionism rather than creationism.1413/

Thompson* also supports the educational merit of balanced treatment as part of teaching alternative explanations:

> When studying science in all fields--biology, zoology, genetics, geology,

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1413. _____, Scientists Abandon Evolution, Contrast, Mar.-Apr. 1982, at 1, 3 (Provine* describes himself as an Atheist).

> astronomy, etc.--we should use all knowledge available to us and should present all of this to our students. Students should be exposed to both sides of the coin regarding biological change--the doctrine of creation and that of evolution-since both are based on models. . . .
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> . . ..
>
> But Scopes would have difficulty recognizing the battlelines of today. Creationists are now espousing one of the arguments of Clarence Darrow's ardent defense of Scopes: that the theory of the beginning should not be taught to the exclusion of another. In short, perhaps creationism should be considered along with the evolutionary theory.1414/

Solomon* reaches a similar conclusion, while condemning the suppresion of minority scientific viewpoints:

> We cannot imagine that the cause of truth is served by keeping unpopular or minority ideas under wraps . . .. Specious arguments can be exposed only by examining them. Nothing is so unscientific as the inquisition mentali-

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1414. A. Thompson*, Biology, Zoology, and Genetics: Evolution Model vs. Creation Model, 2, 271 (1983) ("although he does not view creation-science as scientific.).

1415. P. Davis & E. Solomon*, The World of Biology 414 (1974) (Solomon* is an evolutionist, while Davis is a creationist.).

> ty that served, as it thought, the truth, by seeking to suppress or conceal dissent rather than by grappling with it.1415/

Alexander* notes that balanced treatment can help "to teach students to think":

> No teacher should be dismayed at efforts to present creation as an alternative to evolution in biology courses; indeed, at this moment creation is the only alternative to evolution. Not only is this worth mentioning, but a comparison of the two alternatives can be an excellent exercise in logic and reason. Our primary goal as educators should be to teach students to think and such a comparison, particularly because it concerns an issue in which many have special interests or are even emotionally involved, may accomplish that purpose better than most others.1416/

Anderson* and Kilbourn* acknowledge at least that "an argument for teaching special-creation can be made," and that it applies the

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1416. R. Alexander*, Evolution, Creation, and Biology Technology, in Evolution versus Creationism 90, 91 (J. Zetterburg ed. 1983)(although he does not support legislation of curriculum or regard creation-science as scientific.).

"common device of teaching by comparison and contrast."1417/ A major public school textbook, published by Burgess Publishing Co., also recognizes the educational propriety of balanced treatment (and another major textbook that is quoted below implicit-

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1417. They state:

> Second, we believe that an argument for teaching special-creation can be made, but to plausibly do so requires a conscious shift to the domain of the curriculum controversy. Within that domain there seems to be at least three possibilities: a moral argument concerning the rights of minority groups, a pedagogical argument concerning the common device of teaching by comparison and contrast, and a substantive argument concerning an effort to provoke a student's understanding about the nature of explanation and how it functions. The first of these is obviously a difficult area but should be taken seriously. The last, relatively unexplored, we find genuinely interesting because of its potential for addressing broader issues about the curriculum and what it should be.

Anderson* & Kilbourn*, Creation, Evolution, and Curriculum, 67 Science Education 45, 53-54 (1983) (although they do not regard creation-science as scientific.).

ly reaches the same conclusion by devoting a few paragraphs to creation-science):

> In some school systems, it is mandated that the evolution and special-creation theories be taught side by side. That seems a healthy attitude in the view of the tenuous nature of hypothesis.1417a/

Finally, Morrow* and other evolutionist expert witnesses for the State have endorsed the educational merit of balanced treatment.1418/

1417a. _____*, Natural Science: Bridging the Gap ____ (1981) (although that text does not itself present creation-science). See also V. Webster* et al., Life Science 409, 436-37, 441-42, 444 (1980).

1418. He writes:

> My professional training is that of a molecular biobiologist, or biochemist . . .. I am an evolutionist, and I am not a Christian.
>
> In my opinion, the Balanced treatment for Scientific Creationism and Evolution Act is a reasonable alternative to the current state of affairs for one powerful reason: Students would have available a realistic set of options to explore, discuss, evaluate, and, if they so choose, from which to select a personal answer to the problem of the origin of life.

Letter from Dr. W. Scot Morrow* to Dr. Major Rhodes (_____). (He does regard creation-science as scientific).

The educational merit of balanced treatment, which will be supported at trial by the State's education expert witnesses, has been supported by the noted creationist scientist von Braun (the late director of the NASA space program),1419/ and in a prestigious education monograph series by creationist educational psychologist Bergman.1420/ Darrow*, the ACLU's counsel at

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1419. Von Braun said:

> [T]he scientific method does not allow us to exclude data which lead to the conclusion that the universe, life and man are based on design. To be forced to believe only one conclusion--that everything in the universe happened by chance--would violate the very objectivity of science itself . . ..
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> . . ..
>
> It is in that same sense of scientific honesty that I endorse the presentation of alternative theories for the origin of the universe, life and man in the science classroom. It would be an error to overlook the possibility that the universe was planned rather than happened by chance.

Letter from Dr. Wernher von Braun to Dr. Vernon Grose (Sept. 14, 1972).

1420. That Phi Delta Kappan monograph says:

the Scopes trial, has been quoted earlier as saying that it is "bigotry for public schools to teach only one theory of origins,"1421/ while John Scopes* himself "believe[d] in teaching every aspect of every problem or theory."1422/ The educational merit of balanced treatment of creation-science and evolution is acknowledged by many many ardent evolutionists as well as creationists.

> Probably the strongest pedagogical argument for teaching both theories is that it permits comparisons and contrasts. Teaching by contrasts helps the student to integrate new knowledge within the total framework of the subject. Also, by teaching with an open-ended approach where problems are not solved or "closed" and students are left on their own, students are stimulated to continue searching.

J. Bergman, Teaching About the Creation/Evolution Controversy 35-36 (1979).

1421. Note 1400 supra.

1422. Quoted in P. Davis & E. Solomon*, The World of Biology 414 (1974).

(2) Educational Feasibility of Balanced Treatment with Strictly Scientific Content

Creation-science instruction can feasibly be given, as the State's expert witnesses will demonstrate. The empirical evidence and scientific interpretations that constitute creation-science have been summarized above,1423/ and can be taught without any inclusion of religious material, as also discussed above.1424/ There is no more need to refer to and discuss a creator during creation-science instruction than during evolution instruction,1425/ although that would be clearly constitutional under current precedent.1426/ Teachers will not be any more apt to bring religious doctrine

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1423. Sections 2[a](1), 2[b](1) and 2[c](1) supra.

1424. Section 3 supra.

1425. Section 3[b](2) & (4) supra.

1426. Section 3[b](3)(c) supra and Part B, Section 2[a](1) infra.

into creation-science than into evolution, in that these explanations touch equally on basic issues of the origin of the world, life, and man. Creation-science instruction will not allow or invite presentation of any of the scores of various religious views of creation, any more than presentation of evolution allows or invites discussion of any of the scores of evolutionist religious views of origins.1427/ Textbooks and other curricular materials either exist or can easily be developed based on these empirical evidences and related scientific interpretations.1428/ One major textbook for public high school science does actually summarize part of creation, although it does not give space for the affirmative scien-

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1427. Section 3[c](1)(a) supra.

1428. Affidavits of Dr. Dean H. Kenyon, Dr. W. Scot Morrow*, and Dr. Robert L. Clinkert, Aguillard v. Edwards, No. 81-4787 (E.D. La., filed Dec. 3, 1981) (attached as Exhibits I, II and V).

tific evidences that constitute creation-science and although it erroneously refers to creation of "kinds" and "species":

> Possible Keys to the Past. The variety of organisms on the earth is astounding! No one knows how the various species came to exist. Each species may have been created separately. Or several species may have had common ancestors and diverged. . . .
>
> . . . .
>
> Some people believe that evolution explains the diversity of organisms on the earth. Some people do not believe in evolution. These people believe that the various types of organisms were <u>created</u> as they appear. No one knows for sure how the many different kinds of living things came to be. But many people have developed theories to explain how this diversity may have come about.
>
> . . . .
>
> <u>SPECIAL CREATION</u>
>
> Besides theories of change, some people believe that the many different kinds of organisms are a result of a <u>special creation</u>. These people believe that each organism was created separately. The organisms did not change in form. Instead, they were created as they appear now. Thus, no changes were responsible for the varied appearances and varied kinds of organisms on the earth. Would people who believe in special creation say that the wool-

> ly mammoth and the elephant are related? Why?
>
> . . . .
>
> Theories to explain the diversity of organisms have been suggested by many people. One theory proposes that organisms changed to fit their environment. Another theory proposes a gradual change through chance variation. Still another theory proposes that mutations are solely responsible for variations of species. Many of today's scientists believe that migration and isolation, along with mutations, are factors leading to diversity. And some people believe that a special act of creation rather than change produced the wide variety of species.1428a/

This shows that creation-science could be presented without reference to a creator and without religious content (except that the book mistakenly refers to kinds), even by noncreationist authors.

(3) No Reduction in Evolution Instruction from Balanced Treatment

There is no persuasive reason to think that implementation of balanced treatment

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1428a. V. Webster*, et al., Life Science 409, 436-37, 441-42, 444 (1980).

would bring any reduction in public school treatment of evolution. If it did, however, that would be strictly the choice of individual teachers, rather than a requirement by the state, and would not impair the quality of science instruction because such fields as biology were successfully taught before 1960 without heavy emphasis on evolution and without any mention at all in many textbooks.1429/ At present, one high school biology textbook totally omits evolution and another only mentions it briefly.1430/ In the scientific community, the

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1429. Grabiner* & Miller*, Effects of the Scopes Trial: Was It a Victory for Evolutionists?, 185 Science 833-34 (1974); Troost*, Evolution in Biological Education Prior to 1960, 52 Science Education 300 (1968); G. Skoog*, The Topic of Evolution in Secondary School Biology Textbooks: 1900-1968, Doctoral Dissertation, 31 (1969); G. Skoog*, Topic of Evolution in Secondary School Biology Textbooks: 1900-1977, 63 Science Education 621-40 (1979); G. Skoog*, Coverage of Evolution in Secondary School Biology Textbooks: 1900-1982 at 2, 4-5 (unpublished ms. Oct. 16, 1982).

transformed cladists argue "that no evolu-

1430. P. Bauer*, et al., Experiences in Biology (1981); V. Webster*, et al., Life Science (1980); G. Skoog*, Coverage of Evolution in Secondary School Biology Textbooks: 1900-1982 at 5 (unpublished ms. Oct. 16, 1982) ("Since 1959, only a popular 1960 textbook and a 1981 textbook failed to include the word evolution in either the text, glossary, or index. A 1980 textbook used the word evolution only once and that was in the last sentence of the chapter on evolution. Evolution was not listed in the glossary of this textbook."). The authors of these textbooks are competent science professors and educators, who evidently have the professional opinion that it is not scientifically or educationally necessary for evolution to be taught in these high school science courses. Those authors include Bauer*, associate professor of botany at Colorado State; Magnoli*, professor of science education at Mobile College; Alvarez*, a science curriculum specialist for a public school system; Chang-Van Horn*, a science resource teacher and adviser for a public school system; and Gomes*, an administrator of a public school, for the text Experiences in Biology; and Coble*, a professor of science education at East Carolina University; Webster*, a science consultant in New York; Fichter*, a former zoology instructor at Miami University; and Rice*, a professor of education at University of South Alabama, for the text Life Science.

Others have reached the same conclusion. E.g., Macbeth*, A Third Position in the Textboook Controversy, 38 American Bio-

tionary suppositions are necessary to discover the sort of 'pattern' . . . characteristic of the living world,"1431/ while anti-Darwinian noncreationist scientists oppose all evolutionary theories (as discussed earlier).1432/ Thus, while the Louisiana law does not exclude or limit the teaching of evolution, much noncreationist professional opinion supports that very alternative if teachers actually did select it.

Conclusion. Public school presentation of creation-science along with evolution has educational merit as an offering of alternative scientific explanations, and can be feasibly done. This is a material factual issue.

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logy Teacher 49' (1976); Epperson v. Arkansas,393 U.S. 97, 111 (1968) (Black, J. concurring)(constitutional); Kalven, A Commemorative Case Note: Scopes V. State, 27 U. Chi. L. Rev. 505, 517 (1960)(constitutional).

1431. Beatty*, Classes and Cladists, 31 Systematic Zoology 25, 29 (1982). Accord, Section 2[a](2)(a)(v) supra.

1432. Section 2[a](2)(a)(vi) supra.

c. Material Factual Issue that Current Instruction in Louisiana Public Schools Exclusively Teaches Evolution and Excludes Creation-Science

Overview. Current Louisiana public schools generally present evolution extensively and exclude creation-science in biology and some other courses, as can be seen in the content of the actual textbooks used in Louisiana schools. The typical public school classroom and its impact is described by one noncreationist as follows:

> When I learned my basic Darwin in high school--and neo-Darwinism and new genetics in college--I learned it as dogmatic truth, as I might have learned a religious catechism. Not in the sense that no physical evidence was adduced--there was enough of that--but in the sense that no alternative theory of the evidence was ever introduced, no critical examination of assumptions and incongruities ever encouraged. Indeed, I was led to believe that the only alternative to orthodox biology was biblical fundamentalism and the 'creationist' movement.1437/

1437. T. Roszak*, Unfinished Animal 99-100 (1975).

This exclusive instruction in evolution and exclusion of creation-science denies academic freedom to students and teachers. These are material factual issues.

(1) Exclusive and Extensive Treatment of Evolution and Exclusion of Creation-Science in Louisiana Public Schools

"Presently, the concepts of evolutionary theory . . . permeate the public school textbooks," as the McLean opinion acknowledged,1438/ at least in biology and for some textbooks in other fields. Evolution receives an average of 14,055 words in each of eight major biology textbooks published between 1980 and 1982 (most of which are used in Louisiana public schools), and seven devote at least 11,000 words to evolution.1439/ By contrast, creation-science

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1438. McLean v. Arkansas Board of Education, 529 F. Supp. 1255, 1272 (E. D. Ark. 1982).

does not receive more than a paragraph in any but one of the roughly thirty textbooks for public school biology, is not mentioned in most, and is only mentioned in criticism in the others except one.1440/

The teacher's guidebook for three leading biology texts describes evolution as "pervasive and comprehensive" and "interwoven":

> Because of its pervasive and comprehensive character, evolution is treated in three ways in the BSCS materials. There are specific chapters on evolution as the history of living things. There are specific chapters on evolution as a process. And third, evolution either as history or as process is interwoven in all other chapters where it has a place: in the treatment of cell chemistry, ecology, taxonomy, and so on.
>
> Evolution is another pervasive theme that is developed throughout the

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1439. G. Skoog*, Coverage of Evolution in Secondary School Biology Textbooks: 1900-1982 at 12 (unpublished ms. Oct. 116, 1982).

1440. Note 1430 supra.

> book, but its main treatment comes in Chapter 31-34. The student must have a good background in genetics, as well as some knowledge of the diversity of amimals, before evolution can have its full impact. Chapters 33 and 34 deal specifically with the physical and cultural evolution.
>
> The entire course--indeed, any modern biology course--can be regarded as a summary of the evidence for evolution. The main objective of Chapter 18,"Evolution," then, is not to give the evidence for evolution; that has already been done in several ways, both implicit and explicit. Instead the chief aim is to give the student some idea of the mechanism of evolution.1441/

Each of those three texts (the Biological Science Curriculum Study ones) is indeed permeated with evolution,1442/ as are many

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1441. E. Klinckmann*, Biology Teachers' Handbook 16 (2d ed. 1970). The then-chairman of the board of BSCS wrote that "evolution is not only one of the major themes but is, in fact, central." Lee, The BSCS Position on the Teaching of Biology, BCSC Newsletter, Nov. 1972, at 5. Accord, A. Grobman*, The Changing Classroom: The Role of the Biological Sciences Curriculum Study viii (1969).

1442. In BSCS Blue the general theory is "the most inclusive of the great unifying principles of biology." Biological Science Curriculum Study, Biological Sci-

other leading biology texts[1443] (all of these are used in Louisiana public schools[1444]).

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ence: Molecules to Man 105 (3d ed. 1976). According to the McLean opinion, "fifty percent of American school children currently use BSCS books directly and the curriculum is incorporated indirectly in virtually all biology texts." McLean v. Arkansas Board of Education, 529 F. Supp. 1255, 1259 (E. D. Ark. 1982). Accord, Mayer*, The BSCS Process of Curriculum Development BSCS Newsletter, Sept. 1976, at 4, 8 ("While more than 50 percent of the American high school students now use BSCS materials directly, 100 percent of them are using materials that have been influenced by the BSCS, as publishers have followed the curriculum study lead.").

1443. E.g., J. Otto* & A. Towle*, Modern Biology 14-50, 150-61, 163-64, 166-67, 182, 252-53, 257, 260-61, 262, 264-66, 268, 272, 341, 367, 374, 412-23, 419, 421, 437-38, 441, 452, 454, 456-57, 458, 459, 465, 467, 468, 469, 471-73, 486, 488, 490, 493, 496, 500, 503, 516, 517-21 (1977); R. Oram*, Biology: Living Systems 118, 248-67, 277-94, 602-23, 73T-80T, 142T-45T (3d ed. Teacher's Ed. 1979). Modern Biology, along with the BSCS books, is one of the five leading biology texts. Leonard* & Lowery*, A Criterion for Biology Textbook Selection 38 American Biology Teacher 477, 478 (1976).

1444. La. Department of Education, Louisiana State Adopted Textbooks and Materials of Instruction 359-63 (1981); La. Dept. of Education, List of Adopted Materials 95-99, 475 (1982).

The content of the textbooks is very significant, not only because it is what students read, but because it heavily influences what teachers teach.1445/ Although many evolutionist scientists defend this exclusive and pervasive presentation of evolution,1446/ many do not1447/ and Louisiana's Legislature has seen it as inimical to academic freedom.1448/

1445. Kastrinos*, Survey of the Teaching of Biology in Secondary Schools, 98 School and Society 241, 242 (1970).

1446. E.g., Huxley*, At Random, in 3 Evolution after Darwin 41-65 (S. Tax ed. 1960) ("I would turn the argument the other way around and hold that it is essential for evolution to become the central core of any educational system, because it is evolution, in the broad sense, that links inorganic nature with life, and the stars with earth, and matter with mind, and animals with man. Human history is a continuation of biological evolution in a different form.").

1447. Examples are most transformed cladists and anti-Darwinian scientists, Section 2[a](2)(a)(v) & (vi) supra, as well as many evolutionists and all creationist scientists.

1448. La. Rev. Stat. §17:286.2 ("purposes of protecting academic freedom").

(2) Effective Presentation of Evolution as Fact by Exclusive Treatment

The usual effect of presenting evolution exclusively is to present it as fact or "dogmatic truth," as Roszak* was quoted as saying above. References to evolution as "theory" still amount to its presentation as "fact," as the teachers' guidebook for BSCS texts admits:

> A special word is necessary concerning our habit of referring to the "theory of evolution." This usage is often taken to mean that evolution is but an envisaged possibility, something uncertain and unproved.
>
> This sense of "theory" no longer holds in science, if it ever did . . .. Evolution is a theory in this sense, yes--a body of interrelated facts. As new facts about evolution are discovered, the organization may be changed in order to include them, but this would not mean that the present organization of facts now known is unsound.[1449]

The tendency of public school texts is to present concepts as certain truth (unless

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1449. E. Klinckman*, Biology Teachers' Handbook 16 (2d ed. 1970).

an alternative is also presented), as Nelkin* (an ACLU witness in McLean) notes:

> Textbooks especiallly tend to convey a message of certainty, for in the process of simplification, findings may become explanations, explanations may become axioms, and tentative judgments may become definitive conclusions. Preoccupied with communicating a scientific view of nature, textbooks often neglect to convey concepts of critical inquiry.1450/

The textbooks present evolution not only as fact, but as erroneous fact, in the views of many evolutionist scientists such as Kerkut*:

> At present, however, it is a matter of faith that the textbook pictures are true, or even that they are the best representations of the truth that are available to us at the present time.1451/

1450. D. Nelkin*, Science Textbook Controversies and the Politics of Equal Time 148 (1977) (not speaking specifically of evolution or creation science.).

1451. G. Kerkut*, Implications of Evolution 148 (1960). Accord, Patterson*, Book Review, 29 Systematic Zoology 216, 217 (1980) ("To me one of the most astonishing consequences of the furor over cladistics is the realization that the current account

The misleading dogmatism of textbooks on evolution is noted by Corner* who, although an evolutionist, concedes that "the fossil record of plants is in favour of special creation.":

> Much evidence can be adduced in favour of the theory of evolution--from biology, bio-geography and palaeontology, but I still think that, to the unprejudiced, the fossil record of plants is in favour of special creation. . . . The evolutionist must be prepared with an answer, but I think that most would break down before an inquisition.
>
> Textbooks hoodwink. A series of more and more complicated plants is introduced--the alga, the fungus, the bryophyte, and so on, and examples are added eclectically in support of one or another theory--and that is held to be a presentation of evolution. If the world of plants consisted only of these few textbook types of standard botany, the idea of evolution

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of tetrapod [four-legged vertebrate] evolution, shown in a thousand diagrams and everywhere acknowledged as the centerpiece of historical biology, is a will-o'-the wisp. For nowhere can one find a clear statement of how and why the Recent groups are interrelated, and the textbook stories are replete with phantoms--extinct, uncharacterizable groups giving rise one to another.").

might never have dawned, ...1452/ Stansfield* finds a significant "contribution creationist scientists are currently making to science" in "their recognition of 'creeping dogmatism' in the science of evolution."1453/

Summary. Thus, Louisiana public schools in general exclusively present evolution and exclude creation-science. This amounts

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1452. Corner*, Evolution, in Contemporary Botanical Thought 95, 97 (A. MacLeod & L. Cobley eds. 1961). Accord, Saunders* & Ho*, Is Neo-Darwinism Falsifiable?--And Does It Matter?, 4 Nature and System 179, 191 (1982) ("Neo-Darwinist textbooks on evolution keep citing the same comparatively few examples: industrial melanism, sickle cell anaemia, DDT resistance. All are comparatively minor evolutionary changes; all involve variations in which a large and obvious selective advantage can be obtained by a single allele substitution."); Bonner*, Book Review, 49 American Scientist 240 (1961) ("In the case of phylogeny our textbooks are little help; in fact they are, as a rule, a festering mass of unsupported assertions.").

1453. W. Stansfield*, The Science of Evolution ____ (1977).

to teaching evolution as fact. These are material factual issues.

d. Material Factual Issue that Significant Discrimination Exists against Creationist Scientists and Other Creationists by Schools and Science Publications

Overview. Significant discrimination does exist against creation-science and its proponents. The "intolerant" attitude toward creation-science among "most" evolutionary biologists is acknowledged by Provine*:

> [M]ost biological scientists are intolerant of creationism and do not understand the reasons for the great attraction of the creationist's position.1454/

This intolerance is not shared by the eighty-six percent of the public and the

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1454. W. Provine*, Theories of Creationism and Evolution from a Historical Perspective (unpublished lecture before Sigma Xi Chapter at Corning, N.Y., Nov. 17, 1981). E.g., Schafersman*, _____, Geotimes, Aug. 1981, at 11 (credentialed creationist scientists are by his definition "not scientists").

sixty-seven percent of public school board members that support creation-science instruction,1455/ but it is a serious problem for creationist scientists and teachers and students. That problem prompted the nondiscrimination provision in the Louisiana statute.1456/

(1) Discrimination against Creationist Scientists by Universities and Schools

Many creationist scientists have been denied tenure or discharged by universities effectively because of their scientific conclusions about creation-science.1457/

1455. Note 11 supra; _____*, Poll, American School Board Journal, Mar. 1980, at 52 (48% support balanced treatment, 19% support creation-science instruction only, 25% support evolution instruction only, 8% support excluding both).

1456. See La. Rev. Stat. §286.4C.

1457. Examples of denial of tenure to creationists are Dr. Norbert Smith (Ph.D. in biology from Northeastern Oklahoma State University) at that institution; Dr. David A. Warriner (Ph.D. in chemistry from Cornell) at Michigan State University; Dr. J.

Patterson* concludes that "their chances of achieving or retaining prestigious academic positions" are undermined:

> Were biologists, geologists, or paleontologists to endorse publicly a pseudoscience such as creationism their chances of achieving or retaining prestigious academic positions would be greatly undermined, as would their chances for high office in professional societies. Only in Bible colleges, seminaries, and creationist ministries can the latter succeed as outspoken creationists.1458/

Harold Ellens (Ph.D. in psychology) at Oakland University; Dr. Alvin Bytwork (Ph.D.) at Western Michigan State University; and Dr. Gerald R. Bergman (Ph.D. in educational psychology from Wayne State University) at Bowling Green State University. Examples of discharge of creationists are Dr. Joseph Arnett (Ph.D. in psychology) at University of Illinois; and Prof. Robert Gentry (M.S.) at Oak Ridge National Laboraties. Examples of discharge of creationists at the public school level are Mr. Lloyd Dale, who had been named "South Dakota Outstanding Teacher of the Year," yet was dismissed as a science teacher by the Lemmon Public Schools; and Mrs. DeYoung, who was dismissed as a science teacher by the Middletown public schools in Delaware.

1458. Patterson*, An Engineer Looks at the Creationist Movement, 89 Proc. Iowa Academy of Sciences ___, 57 (1982). Accord,

Many creationist students have been denied earned degrees, prevented from completing academic programs, or denied entrance into graduate study for which they otherwise qualified, because of similar discrimination.1459/ For example, Patterson*, a pro-

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F. Hoyle & N. Wickramasinghe, Evolution from Space 147 (1981) ("We have received hints and even warnings from friends and colleagues that our views on these matters are generally repugnant to the scientific world. We in our turn have been disturbed to discover how little attention is generally paid to fact and how much to myths and prejudice.").

1459. Examples of denial of earned degrees to creationists are Byron Nelson at Rutgers University being denied his M.S. in genetics; Dr. Richard Culp at University of Michigan being denied his Ph.D. in zoology; Professor George Mulfinger being denied his Ph.D. in science education at Syracuse University; Clifford Burdick (after completing his dissertation) being denied his Ph.D. in geology at University of Arizona; and Dr. Erville Clark being denied his Ph.D. in biology at Stanford. Examples of denials of entrance into graduate programs to creationist students are Thomas Jungman being excluded from the Ph.D. program (despite academic success in the M.S. program) at various institutions because of an unfavorable and anti-creationist letter of recommenda-

fessor of material science and engineering at Iowa State, states that he would fail a creationist student who otherwise passed his course but did not give valid scientific evidence for creation-science to Patterson's* satisfaction, and would place a disparaging reference on a creationist student's transcript (which would preclude graduate study in science) who could state evolutionist arguments while personally rejecting them:

> I would not fail a student outright simply on the basis of the above answers but would certainly consider it necessary to check further into his/her command of the subject. The best way to do this, in my view, would be to request that they detail their scientific arguments and reasons for their answers. If those arguments turned out to be scientifically counterfeit or badly fallacious, as are those of the present day creation scientists (sic), or if their reasons were contradictory to scientific facts or contradictory to certain other the-

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tion from San Jose State University; and Professor David McQueen being excluded from the Ph.D. program at a Michigan University.

ories of science (e.g. thermodynamics), then I would consider these persons to either be imposters or seemingly hopeless incompetents (probably due their being misled by evangelists from the creationist movement). Moreover, I would keep their answers on file as powerful evidence of their incompetence and then proceed to submit a failing grade . . . even if their success on the memorization parts of the quizzes etc. were enough to carry them into the passing range (on paper). In other words, I would use my professional judgment in a case like this and if I thought the new findings superseded the overall averages on exams (which are always incomplete barometers of competence anyway and should only be used as guidelines when more definitive information is lacking), then I would overrule those scores on the basis of the answers I got from the special investigation.

Another case is worth noting here. Suppose the student gives the correct scientific answers in his or her science course and suppose he/she also knows and gives the correct scientific arguments and reasons for the follow-up question, but still insists on rejecting all this for reasons of incompatibility with his/her religious beliefs. In this case, I would prefer to pass he student strictly according to the usual scoring criteria but with the proviso that his rejection of the subject matter for religious reasons be noted on his transcript of grades.1460/

(2) Discrimination against Creationist Scientists by Science Publications

Many creationist scientists have had manuscripts rejected by the major science publications because of anti-creationist discrimination, and many more have not submitted manuscripts because of inevitable discriminatory rejection.1461/ For example, Dr. Stefan Marinov suffered rejection of his papers opposing cosmic evolution by thirty-seven journals as reported in Nature (the publication of the British science organization):

> For some years, Dr. Marinov has submitted papers and proposals concerning

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1460. Letter from Professor John W. Patterson* [of Iowa State University] to Mr. Kevin Wirth (Feb. 7, 1984).

1461. The McLean opinion found that "not one recognized scientific journal . . . has published an article espousing the creation science theory," although no evidence was there provided of rejection of creationist articles by scientific journals. 529 F. Supp. at 1268.

> 'absolute spacetime' to such bodies, with--by his own account--a rather small degree of success. Literal copies of this correspondence make up the bulk of his book and are absorbing reading.
>
> Between these two lie the responses of some 35 other journals and the National Science Foundation (four referee reports followed by formal appeals up successive rungs of the hierarchy).
>
> All readers should note how, in this case at least, the system seems to have ensured that orthodoxy prevails--deciding for themselves whether by malevolent conspiracy, inertia or good sense.1462/

Similarly, Robert V. Gentry published a dozen scholarly articles on radiohalos in refereed science journals, but has had every manuscript rejected since publicly stating his creationist interpretation of his polonium halo research as an affirmative evi-

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1462. Unorthodox Assessments, 300 Nature 566, 566 (1982).

1463. Compare note 627 supra (Gentry publications before his creationist stance) with R. Gentry _____ (1984) (in press) (record of discrimination and publication rejections after his public creationist stance).

dence for creation-science.1463/

This great difficulty encountered by creationist scientists in publishing science articles related to creation-science is evident in the active participation in the anticreationist meetings of many of the scientific organizations that sponsor scientific journals, such as the 1981 meeting sponsored by the National Academy of Sciences and attended by representatives of the American Association for the Advancement of Science (publisher of Science), American Museum of Natural History (publisher of Natural History), the National Association of Biology Teachers (publisher of American Biology Teacher), National Science Teachers Association, American Institute of Biological Sciences, American Geological Institute, American Society of Biological Chemists, American Anthropological Association, Federation of American Societies for Experimen-

tal Biology, etc.1464/ This is a material factual issue.

Conclusion. Balanced treatment of creation-science and evolution is at least as educationally meritorious as exclusive instruction in evolution, because alternative scientific explanations are thereby offered and academic freedom is thereby enhanced. Discrimination currently exists against creation-science and creationist scientists by evolutionists in many critical forms. These are material factual issues.

1464. A. Lasen*, Summary Report: Meeting on Creationism-Evolutionism (National Academy of Sciences Oct. 19, 1981).

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2. THE ESTABLISHMENT CLAUSE IS NOT VIOLATED BY BALANCED TREATMENT OF CREATION-SCIENCE AND EVOLUTION

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d. The Legislative Purpose of Balanced Treatment Is the Constitutional Purpose of Advancing Academic Freedom

Overview. Balanced treatment for creation-science and evolution also conforms to the second prong of the tripart test for the establishment clause-the secular purpose requirement-if that tripart test is used in this case. Section (1) discusses the Louisiana legislative history with its clear purpose of advancing academic freedom, corroborating the stated purpose in the statute. Section (2) discusses the irrelevance of individual legislators' views in determining the legislative purpose, with extensive U.S. Supreme Court authority. Section (3) describes how the legislative purpose prong prohibits only an "exclusive" nonsecular purpose while permitting statutes

with a secondary nonsecular purpose. Section (4) discusses decisions upholding the constitutionality of analogous legislative purposes. Section (5) distinguishes this case from Epperson, while Section (6) distinguishes it from McLean. Very significantly, the Fifth Circuit has held that summary judgment is inappropriate for cases involving purpose or intent questions such as this legislative purpose issue.1649/

1649. Riley-Stabler Construction Co. v. Westinghouse Electric Corp., 401 F.2d 526, 527 (5th Cir. 1968) ("Where state of mind is to be measured it cannot be resolved on summary judgment.") Accord, Crowley v. Mentson Navigation Co., 434 F.2d 73, 77 (5th Cir. 1970) ("The Court should be cautious in granting a motion for summary judgment when resolution of the despositive issue requires a determination of state of mind."); Feminist Women's Health Center, Inc. v. Mohammad, 586 F.2d 530, 552 (5th Cir. 1978) (good faith.)

Moore states the general rule:

> As a general proposition, summary judgment is likely to be inappropriate when issues of motive, intent, and other subjective feelings and reactions are material.

(1) Louisiana Legislative History with a Legislative Purpose of Advancing Academic Freedom

Overview. The legislative purpose of the Louisiana Act for Balanced Treatment of Creation-Science and Evolution-Science is the constitutional purpose of advancing academic freedom, as the Act, its legislative history, and its predictable impact indicate. This purpose of advancing academic freedom was stressed by Sen. Keith and nearly every witness for the Act at every single legislative hearing, while denials of any desire to bring the Bible into public schools were reiterated at every hearing. The scientific and nonreligious nature of creation-science was stressed by nearly every witness, and the improper definitions of creation-science

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6 (pt. 2) Moore's Federal Practice ¶56.17 [41.-1] (2d ed. 1982). See also C. Wright, A. Miller & M. Kane, Federal Practice and Procedure §2730 (1983).

that appeared in the Arkansas law were rejected by the Louisiana Legislature with the unanimous support of Sen. Keith and other legislators and the witnesses. The legislative history has been seriously distorted in the ACLU's account (which is a material factual issue), as discussed below.

Stated Purpose. The Act's purpose is "to advance academic freedom,"1650/ and this stated purpose generally should not be disregarded, as the U.S. Supreme Court has stated. 1651/

1650. La. Rev. Stat. § _____.

1651. Committee for Public Education & Religious Liberty v. Regan, 444 U.S. 646, 654 (1980) ("Addressing first the testing provisions, we note that here, as in Wolman, there is clearly a secular purpose behind the legislative enactment: "To provide educational opportunity of a quality which will prepare [New York] citizens for the challenge of American life in the last decades of the twentieth century." New York Laws 1974, ch. 507, §1."); McGowan v. Maryland, 366 U.S. 420, 445 (1961); Womens Services, P.C. v. Thone, 483 F.Supp. 1022, 1038 (D. Neb. 1979), aff'd, 636 F.2d 206 (8th Cir.

Legislative History. The legislative history for the Balanced Treatment Act underscores the accuracy of the stated purpose of protecting academic freedom. The primary sources and ordinarily the sole sources of legislative history are the text of a bill and official transcripts of committee hearings. Statements by individual legislators are not determinative, and statements by nonlegislators other than in official transcripts are not relevant (as discussed below). The Act and predecessor bills were

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1980)(expressly affirming the establishment clause issue), vacated on other grounds, 450 U.S. 398 (1981), aff'd on remand, 690 F.2d 667 (8th Cir. 1982), vacated on other grounds, __ U.S. __, 103 S.Ct. 3102 (1983)); Akron Center for Reproductive Health, Inc. v. City of Akron, 479 F.Supp. 1172, 1189 (N.D.Oh. 1979); aff'd in relevant part and reversed in part on other grounds, 651 F.2d 1198 (6th Cir. 1981), aff'd in part and reversed in part on other grounds, __ U.S. __, 103 S.Ct. 2481 (1983); see generally Seldman, The Establishment Clause Religious Influence on Legislation, 75 Nv. U. L. Rev. 944 (1980).

carefully considered at hearings on four different days for the Senate committee, two days for joint House-Senate committees, and one day for a House committee.1652/ Those hearings involved testimony on behalf of balanced treatment of creation-science by a number of scientists, and no such testimony by any clergymen.1653/ The House hearing on

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1652. These were the Senate Committee on Education on June 19 & 24, 1980; the Joint Committee on Elementary, Secondary & Vo-Tech Education on Nov. 25, 1980; the Joint Subcommittee on Elementary & Secondary Education on Dec. 16, 1980; the Senate Committee on Education on May 21 & 28, 1981; and the House Committee on Education on June 25, 1981. All quotations from the transcript of these hearings are corrected for spelling and punctuation, without further indication unless the correction is arguable.

1653. The scientists and science professionals testifying on behalf of balanced treatment included Dr. Edward Boudreaux (Ph.D), professor of chemistry at University of New Orleans; Dr. Myron Young (Ph.D.), professor at Louisiana State University; Dr. Charles Harlow (Ph.D.), professor of engineering at Louisiana State University; Prof. Stanley Morris (M.S.), professor of physics at Southern University; and Dr. Ken Sanderford (Ph.D.), professor at Louisiana Technical University. Other testimony was by Mr. Nick Kalivoda & Mrs. Kay Reiboldt.

an attempted repeal of the bill also involved testimony by four scientists with no clergy support through testimony.1654/ The Act was as much supported by Roman Catholic legislators as Protestant legislators, and in fact was approved by an overwhelming margin of 26 to 12 in the Louisiana Senate and 71 to 19 in the House of Representatives.

Impact. The impact of the Balanced Treatment Act, in providing more scientific information, corroborates the stated legislative purpose of advancing academic freedom. This is evident in the remark by Clarence Darrow, of Scopes trial fame, that it

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1654. Those testifying at the House hearing on the attempted repeal included Dr. Dean Kenyon (Ph.D. from Stanford), professor of biology, San Francisco State University; Dr. W. Scot Morrow (Ph.D. from U.N.C. at Chapel Hill), professor of chemistry at Wofford College; Prof. Raymond Minchew (M.S.), professor of science at LSU Lab School; and Dr. Edward Boudreaux (Ph.D.), professor of chemistry at University of New Orleans.

is "bigotry for public schools to teach only one theory of origins."1655/ Similarly, John Scopes himself acknowledged the secular purpose behind presenting both explanations of origins:

> Education, you know, means broadening, advancing, and if you limit a teacher to only one side of anything the whole country will eventually have only one thought, be one individual. I believe in teaching every aspect of every problem or theory.1656/

(a) Academic Freedom as the Repeated Purpose and Pervasive Emphasis of the Legislature. The legislative purpose was advancing academic freedom, as was reiterated at every legislative hearing by Senator Bill Keith and nearly every witness, as well as was announced in the Act's statement of purpose.

1655. R. O'Bannon, Creation, Evolution and Public Education 5, Dayton Symposium on Tennessee's Evolution Laws (May 18, 1974).

1656. P. David & E. Solomon, The World of Biology 414 (1974).

Sen. Keith's Statements. At the first hearing on Act 685, Sen. Keith stated explicitly that his own purpose was to protect academic freedom by ending "censorship" of scientific data:

> Is there a body of scientific evidence that is being censored from our classrooms, and can it be substantiated scientifically as a body of scientific evidence? If that body exists, then I think a determination will have to be made based on that one question. You know it has been made a religious issue. I've been accused of wanting to teach the first chapter of Genesis in our science classrooms in our public schools. Not only would I be opposed to that (I have never advocated that), but scientists all across the country are telling me "yes, there is a wealth of scientific data, pure scientific data, that points to creationism"; and that's why I introduced this bill.1657/

At the next legislative hearing, in which the improper definitions of creation-science were deleted with Sen. Keith's support

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1657. Senate Committee on Education, tr. at 2 (May 21, 1981). Accord, id. at 3, 8.

(which definitions appear in the Arkansas statute), Sen. Keith again stressed academic freedom as his purpose:

> Gentlemen, I submit to you today that scientific creationism is a bona fide science. I have enumerated six or seven of the tenets of this bona fide science, and yet today it is being censored from our classrooms. And I'm saying that if we're going to teach evolution, this group of some of the finest scientists in America said that the classical Darwinism (which most students learn when they are in high school), that the fossils point overwhelmingly away from this. If we are going to continue to teach that, then we need to balance it with scientific data that points to creationism.1658/

At the final hearing, Sen. Keith again repeated his purpose of furthering academic freedom.1659/ In the three substantive hearings on the predecessor bill, Sen. Keith consistently stressed his purpose on

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1658. Senate Committee on Education, tr. at 15 (May 28, 1981). Accord, id at 16.

1659. House Committee on Education, tr. at 58,52 (June 25, 1981). Accord, id. 8, 10, 11, 12.

advancing academic freedom:

> My intent is to see to it that our textbooks are not censored. Right now, those facts that point toward creationism are being censored. In Clarence Darrow's closing arguments in the Scopes trial, he said it is absolutely "bigotry to teach only one concept."
>
> . . ..
>
> I believe that the question is one of academic freedom. Even some of you refer to the question of academic freedom. I believe that only academic freedom is: Will the student be given the choice -- or will he only receive one model of indoctrination on origins? That is censorship when he is not given both views.1660/

Witnesses' Statements. The scientist witnesses at the hearings on behalf of balanced treatment also stressed academic freedom as the purpose for balanced treatment. At the continuation of the first hearing on Act 685, Dr. Edward Boudreaux of University

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1660. Joint Subcommittee on Elementary and Secondary Education, tr. at 30, 32 (Dec. 16, 1980). Accord, Joint Committee on Elementary, Secondary and Vo-Tech. Education, tr. at 2, 3, 5 (Nov. 25, 1980). Joint Subcommittee on Elementary Secondary Education, tr. at 28, 31 (Dec. 16, 1980).

of New Orleans stated this pervasive academic freedom theme, as he did at the other hearings:

> In fact, what the bill is actually supporting in my opinion is academic freedom: freedom to teach science objectively in the way that it should be taught and not biasedly.1661/

Similar academic freedom arguments were made by most of the other witnesses for Act 685, as well as for the prior bill.1661a/ The objective conclusion is that advancement of academic freedom was "a secular purpose" for the Act as required by the Establishment Clause, and in fact was the primary if not

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1661. Senate Committee on Education, tr. at 16 (May 28, 1981). Accord, House Committee on Education, tr. at 2 (June 25, 1981). Joint Committee on Elementary, Secondary and Vo-Tech. Education, tr. at 14 (Nov. 25, 1980).

1661a. E.g., House Committee on Education, tr. at 10-11, 12 (June 25, 1981). Senate Committee on Education, tr. at 9, 10, 11, 11-12, 12 (June 19, 1980); Joint Committee on Elementary, S econdary and Vo-Tech Education, tr. at 14, 17, 24, 25, 33, 34, 35 (Nov. 25, 1980).

the exclusive legislative purpose for the Act (although the Establishment Clause does not require more than "a" secular purpose).

(b) Lack of Any Religious Purpose (and Certainly Lack of an Exclusive Religious Purpose) of the Legislature. The lack of any religious legislative p urpose can be seen not only in the overwhelming vote by legislators of all religious faiths in favor of the Balanced Treatment Act, but in the unanimous legislative decision to delete the faulty illustrations of creation-science given in the original draft that provided the primary ground for the McLean decision, and in the explicit statements of Sen. Keith and also all expert witnesses testifying in behalf of the Act. The Legislature also clearly did not have a legislative purpose to enact the concepts in Sen. Keith's first bill, for the simple reason that the Legislature did not pass that bill and did not

even vote it out of committee.

Deleted Illustrations. The Senate Committee on Education unanimously deleted the faulty illustrations of creation-science contained in the initial draft of Act 685, at the second session of the very first hearing on that bill. It did so with Sen. Keith's full consent and without any objection from the three creationist expert witnesses present at the hearing. The legislative reason for this deletion was that "maybe there are some things in here that ought not have been included" as illustrations of creation-science.

> Sen. Byres: . . . these two amendments would strike from the bill these different illustrations from both of the definitions . . .. I don't know personally why all of those things are or should be included in the law; I think they ought to be excluded from it. Sen. Keith seems to agree with me, and certainly I have no experience and no knowledge as to whether this should be an all inclusive list. Maybe there are some things that are not included in here that some person smarter than

> us would have thought of that should have been included. Maybe there are some things in here that ought not have been included. I don't know. Whoever drafted the bill evidently had this list and put these in; my amendments would strike those out. I don't think it does any violence to the bill.
>
> . . . .
>
> Sen. Brinkhaus: First, are there any questions from the members of the committee? Senator Keith? Senator Keith has indicated that he has no objections to the amendments offered to Senator Saunders. Is there any objection from any member of the committee? Hearing none, the amendments are adopted. . . .[1661b]

Thus, the Legislature deleted these improper illustrations immediately and unanimously. No effort was made in the next committee hearing or at any other time, by Sen. Keith or anyone else, to restore or affirm these portions of the initial draft. Moreover, as the ACLU concedes, these faulty illustrations of creation-science were not drafted by Sen. Keith, but were in the ori-

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1661b. Senate Committee on Education, tr. at 18-19 (May 28, 1981).

ginal draft he received of a possible statute, and thus were not necessarily within his individual purpose. The immediate and unanimous rejection without subsequent re-addition by the Legislature shows its legislative purpose not to define creation-science as including creation "from nothing" or "ex nihilo," creation of " kinds," a "worldwide flood," a "relatively recent inception," etc. Of course, these were the very terms that formed the basis for most of the McLean opinion.

Legislative Statements. At the very first legislative hearing on Act 685, Sen. Keith explicitly stated that the bill provided not for teaching of religion but for teaching of scientific data, and that he in fact would oppose the teaching of Genesis:

> I think that the question boils down to this: Is there a body of scientific evidence that is being censored from our classrooms, and can it be substantiated scientifically as a body of

> scientific evidence? If that body exists, then I think a determination will have to made based on that one question. You know it has been made a religious issue. I've been accused of wanting to teach the first chapter of Genesis in our science classrooms in our public schools. Not only would I be opposed to that (I have never advocated that), but scientists all across the country are telling me "yes, there is a wealth of scientific data, pure scientific data, that points to creationism"; and that's why I introduced this bill.[166]lc/

At the very next legislative hearing, Sen. Keith stressed that the issue was not a religious issue but a scientific issue, outlined several examples of scientific evidence as part of creation-science, and concluded that creation-science is scientific data that is being "censored":

> I have never had a pastor testify on behalf of this bill, because I do not think it's a religious issue. I think it is a scientific issue, and I believe it does great wrong to try to make

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166lc. Senate Committee on Education, tr. at 13, 15 (May 28, 1981. Accord, id at 3.

> this a religious issue. . . . Gentlemen, I submit to you today that scientific creationism is a bona fide science. . . . If we are going to continue to teach [Darwinism], then we need to balance it with the scientific data that points to creationism.166ld/

At the final hearing, Sen. Keith again explicitly stated that creation-science is as good science as evolution, is totally separate from the Bible, and is not religious:

> [T]here has been a lot of misrepresentation about what scientific creationism really is . . .. For instance, some people try to make it a religion versus science conflict, and that's simply not true, because there is, there are a growing number of people in this nation who have learned that scientific creationism is just as good science, if not better science, than evolution science. . . . Therefore, what we will attempt to establish today is that there is a body of scientific evidence, a body of scientific data, called scientific creationism that is totally apart and separate from the Bible. . . . So, I think that from a broad spectrum of people, apart from those scientists who are here at this

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166ld. Senate Committee on Education, tr. at 13, 15 (May 28, 1981). Accord, id. at 22.

> table this morning, we are going to try to show today that there is a body of evidence known as creation-science that is totally apart from the teaching of the Genesis account of creation.[166]e/

Sen. Keith made the argument that the bill did not involve teaching the Bible or other religious concepts at each of the three legislative committee sessions on Act 685, as well as at all substantive hearings at which he spoke on his prior bill[166]f/ (although that very different and rejected bill is not very indicative of the legislative purpose for Act 685).

Legislative Witnesses. The witnesses for Act 685 also unanimously stressed that it would not involve any religious instruc-

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166e. House Committee on Education, tr. at 2-4 (June 25, 1981). Accord, id. at 58.

166f. Joint Committee on Elementary, Secondary and Vo-Tech Education, tr. at 2, 3-4 (Nov. 25, 1980). Joint Subcommittee on Elementary and Secondary Education, tr. at 30, 31, 32 (Dec. 16, 1980).

tion but instead scientific instruction, as shown in the examples in the next Section.[166lg] Similarly, the expert witnesses on the first Keith bill consistently stressed the same points.[166lh] Babs Minhennette, whose three-sentence statement on the first Keith bill is quoted by the ACLU Brief, had not been invited by Sen. Keith to speak (he had just stated that his presentation was concluded), and Sen. Keith was apparently not even aware of her presence.[166li] Thus, her words do not reflect either Sen. Keith's purpose or the legislature's purpose; and her words in

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166lg. Senate Committee on Education, tr. at 6 (May 21, 1981). Senate Committee on Education, tr. at 16 (May 28, 1981). House Committee on Education, tr. at 6, 9, 11-12 (June 25, 1981).

166lh. Senate Committee on Education, tr. at 7, 8, 11 (June 19, 1980). Joint Committee on Elementary, Secondary and Vo-Tech Education, tr. at 2, 12, 13, 18, 19, 24, 33, 35 (Nov. 25, 1980).

166li. Senate Committee on Education, tr. at 12-13 (June 19, 1980).

fact are less religious than those of some of the witnesses opposing balanced treatment.

(c) Scientific and Non-Religious Nature of Creation-Science in Legislative Considerations. The description of creation-science in the legislative hearings of Act 685 by legislators and favorable expert witnesses uniformly stressed its scientific and nonreligious nature.

Legislative Statements. Sen. Keith, in addition to the statements quoted or cited above, described the "scientific data that points to creation" of which creation-science consists, at the second session of the first legislative hearing, as follows:166lj/

> Another Nobel Prize winner, Sir John Eccles in 1963, was talking about the possibility, the probability of evolution. And gentlemen, he said that you put in the improbability of life not being created by an intellgent mind

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166lj. Senate Committee on Education, tr. at 22 (May 28, 1981).

at 400,000,000,000,000,000,000,000,000,000,000 to 1. This is what creation scientists are trying to tell us today. I would just read one other item here from Newsweek Magazine in the science column of November 3 of last year. It's discussing a meeting at the Chicago Museum of Natural History of 160 of the world's top paleontologists, anatomists, evolutionists, and developmental biologists; and here is what they overwhelmingly said. "Evidence from fossils now points overwhelmingly away from the classical Darwinian theory which most Americans learned in high school." . . . Now I want you to listen to what creation-science is. First of all, creation scientists believe the second law of thermodynamics points to creation. . . .. Another point of creation scientists is biogenesis. . . . Biogenesis effectively kills the concept of evolution. . . . Dr. Boudreaux gave you a very, very detailed presentation last week of the mathametical impossibility for evolution. . . . This is creation-science. There are two others. In the area of the fossil record, gentlemen (the battleground in the next decade between creationism and evolution is going to be fought in the fossil record, you see), the evolutionists have a very serious problem with the fossil record. . . . Therefore, creation scientists tell us that the fossil record points to creation and not to evolution. . . . I submit to you today that scientific creationism is a bona fide science. I have enumerated six or seven of the tenets of

> this bona fide science, and yet today it's being censored from our classrooms 1661k/

Sen. Keith made similar points at the other legislative hearings on Act 685,1661l/ as well as at the legislative hearings on his prior bill1661m/ (although they are only marginally relevant).

Legislative Witnesses. All expert witnesses similarly stressed that creation-science is scientific and nonreligious, at hearings on Act 685. For example, Dr. Charles Harlow of Louisiana State University stated:

> There is a fair body of knowledge that can be taught in creation [science].

1661k. Id. at 14-15.

1661l. Senate Committee on Education, tr. at 2, 3 (May 21, 1981). House Committee on Education, tr. at 2, 4, 58 (June 25, 1981).

1661m. Joint Committee on Elementary, Secondary and Vo-Tech. Education, tr. at 2, 3-4 (Nov. 25, 1980). Joint Subcommittee on Elementary and Secondary Education, tr. at 28, 30, 32 (Dec. 16, 1980).

> It has to do with [data] from astronomy where you can show that the universe was created. It has to do from studies of the fossil record which, of course, shows sudden transitions rather than the continual transitions required. Other facts have already been alluded to, and there is a list of about ten or twelve here that can be given, but I will pass on that.[166ln]

Similar statements were made by other witnesses at hearings on Act 685,[166lo] as well as at hearings on the prior Keith bill.[166lp] In fact, most of the affirmative scientific evidences described in this Brief, of which creation-science consists, were described or alluded to in these legislative hearings.

(d) Correction of the ACLU's Distorted Description of the Legislative History.

166ln. House Committee on Education, tr. at 9 (June 25, 1981).

166lo. Id. at 10, 11, 12; Senate Committee on Education, at 16 (May 28, 1981).

166lp. Senate Committee on Education, tr. at 4, 7, 8, 9, 11 (June 19, 1980); Joint Committee on Elementary, Secondary and Vo-Tech Educ., tr. at 11, 12, 13, 14, 18, 19, 24, 28-29, 33, 35 (Nov. 25, 1980).

The strongest indication that the legislative history and legislative purpose themselves are material factual issues is the strong disagreement between the State and the ACLU over that legislative history and purpose. The ACLU has by selective quotation painted a very misleading and out-of-context picture of the legislative history. (Parenthetical page numbers refer to the ACLU Memorandum in Support of Summary Judgment.)

Prior Bill (Pp. 7-9). The ACLU begins with a description of Sen. Keith's first bill (pp. 7-9); but that bill does not indicate the legislative purpose because it not only was not enacted but was not even voted out of committee, and in fact was abandoned by Sen. Keith himself. The term "creation ex nihilo" (p. 7) that appeared in Keith's first bill was not included in what became the Balanced Treatment Act, and

the definition of creation as "from nothing" was unanimously dropped at the second session of the very first committee hearing on the bill that became Act 685 (as described above). Sen. Keith did not equate the "theory of creation ex nihilo" (which is a phrase he did not use at the legislative hearing) with "what we will be referring to today as scientific creationism," contrary to the statement in the ACLU Memorandum (p. 8). Mr. Sunderland, the witness quoted by the ACLU, testified only on the 1980 Keith bill, and so his comments are not relevant to the 1981 bill (p. 9). The statement by Babs Minhennette (p. 9) was not part of Sen. Keith's presentation, and he was evidently not aware of who she was (as discussed above).

Mr. Ellwanger (Pp.10-11). The personal purpose of Mr. Paul Ellwanger (p. 10-11), who never testified or submitted statements

to any legislative hearing and evidently never communicated with any other legislator besides Sen. Keith, is at best marginally relevant to the legislative purpose. His personal religious views were not necessarily his individual purpose for developing a model bill for balanced treatment; they do not become Sen. Keith's individual purpose for introducing Mr. Ellwanger's bill (which Sen. Keith and the Legislature substantially amended); and they have nothing at all to do with the Legislature's purpose in enacting the amended Act 685). Further, the context of his statements is a desire "for redress of a grievance" arising from exclusively teaching evolution and excluding creation-science, as stated in his first letter to Sen. Keith (Ex. B), and a desire for the teaching of scientific data (which the ACLU does not quote him on):

> Quite simply, scientific creationism

> could, just as evolution is, be called a theory, based on scientific evidences and inferences drawn from those evidences by creation-scientists. Biblical creationism, on the other hand, is a faith, based on what the Bible tells us about origins, and as such it is prohibited by this bill.
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> . . . .
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> Biblical creationism, in addition to being prohibited by this bill, is really a matter for the home and the churches. . . . [I]t matters not an iota what a person's theological viewpoint is, simply because the bill prohibits anyone from imposing their theology on students in the public (K-12) schools. . . .166lq/

He has also stated the following, that shows that his personal motivation was as far as it could possibly be from a "Fundamentalist" motivation (contrary to the McLean finding):

> Though I have been unable to determine just what a "fundamentalist" is, I would rather doubt that such persons would care to share that title with a Roman Catholic, which makes the ACLU charge all the more obscene that my legislative effort is some kind of

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166lq. Letter from Mr. Paul Ellwanger to Sen. Keith (Sept. 8, 1980) (ACLU Ex. C).

fundamentalist conspiracy.

> I and my organization, Citizens for Fairness in Education, are the sole national circulators of a uniform origins act in America. We have, in fact, been opposed by several creationist, fundamentalist, and other religious groups who are against legislating for openness in science on origins.166lr/

Prior Bill Hearings (Pp. 12-16). While the ACLU points out that "the model bill provided the same definition of 'creation-science' as did the Arkansas Creationism law" (p. 12), it does not there point out that the Louisiana Legislature explicitly and unanimously deleted the six illustrations that formed the primary basis for the McLean decision, with the support of Sen. Keith and without any objection from the favorable expert witnesses. The ACLU quotes Dr. Boudreaux and Dr. Young from written

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166lr. Ellwanger, Are Creationists Second Class Christians and Jews? Are Christians and Jews Second Class Citizens? Christian News, May 24, 1982, at 9.

statements that were not orally read at legislative hearings on the first Keith bill (pp. 13, 14), but does not quote their actual language at the legislative hearings affirming that creation-science is scientific, consists of scientific data, and is not religious.166ls/ The ACLU Memorandum consistently confuses written statements such as these on oral testimony at hearings on the first Keith bill with testimony on the actual bill that became Act 685.

The Memorandum quotes Dr. Harlow as "preferring" that neither explanation be taught (p. 14), in a hearing on the prior bill, but leaves off the rest of his statement: "I feel as a parent, as an interested

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166ls. Senate Committee on Education, tr. at 16 (May 28, 1981). House Committee on Education, tr. at 6-8, 11-12 (June 25, 1981). Senate Committee on Education tr. at 12 (June 19, 1980). Joint Committee on Elementary, Secondary and Vo-Tech Education, tr. at 12-14 (Nov. 25, 1980).

person, the alternative idea should be presented also . . .. You can approach this scientifically as I said before."166lt/ The Memorandum also quotes Tom Ward as saying "I object to the idea that it is taught as a theory" (p. 14), at a hearing on the first bill, but misinterprets this to have Ward oppose the teaching of evolution rather than merely opposing the teaching of evolution "as a theory" (rather than as a hypothesis). The Memorandum quotes the written statement of Pro-Family Forum (p. 15), at hearings on the prior bill, but does not note that the Legislature in considering the bill that became Act 685 rejected the references to "kinds" and "super-natural" processes in rejecting the illustrations of creation-science. Further, it does not

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166lt. Joint Committee on Elementary, Secondary and Vo-Tech. Education, tr. at 17-18 (Nov. 25, 1980).

quote the actual oral testimony of the Pro-Family Forum member (Mrs. Reiboldt) about creation-science consisting of scientific evidence and academic freedom being furthered by openness in science.166lu/ The ACLU Memorandum states incorrectly that favorable witnesses identified the Creation Research Society, Institute for Creation Research, Dr. Henry Morris, and others "as authorities on 'creation-science'" (pp. 13, 15), yet no one at any of the hearings said any such thing.

It also quotes Rep. Landrieu as suggesting a religious alternate view on every issue taught in public schools (p. 16), but she made her statement in opposing rather than supporting the initial bill. The Memorandum also describes Sen. Keith as

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166lu. Joint Committee on Elementary, Secondary and Vo-Tech. Education, tr. at 32, 33, 34-35 (Nov. 25, 1980).

discussing "the role of God in 'creation-science'" (p. 16), but he did not use the term "God" or say anything of the sort. Again, these hearings on a prior bill do not reflect the legislative purpose for the Balanced Treatment Act. In fact, that first bill never even made it out of committee, never received a favorable vote, and was abandoned by Sen. Keith.

Act 685 (Pp. 18-20). The ACLU Memorandum refers to "some amendments" (p. 18), but does not there emphasize that these were major amendments deleting as improper the faulty illustrations of creation-science given in the initial draft (as discussed above). It quotes Sen. Keith as saying on a single occasion his "preference would be that neither be taught" (p. 19), but does not place that against the background of his strong support for a bill requiring the teaching of creation-science and evolution

if either is taught. The ACLU also fails to point out the overwhelming margins by which the amended bill passed the House (71 to 19) and Senate (26 to 12) (p. 20).

Prior Legislative Efforts (Pp. 24-26). The ACLU Memorandum refers to the Balanced Treatment Act as "but the latest tactic in a long line of legislative efforts to either inject Biblical creation into the public schools or to prohibit the teaching of evolution" (p. 24). However, the ACLU does not (and could not) identify a single instance in Louisiana of such a mythical "long line of legislative efforts." Instead, Louisiana has never passed an antievolution law (unlike Arkansas), and did not even report Sen. Keith's first bill out of committee for any vote. While the ACLU refers mythically again to "creationists shift[ing] their approach" and deciding that "creationism should be cloaked in scientific garb"

(p. 26), it ignores the essence of creation-science as scientific data (as discussed earlier) and unfairly attributes tactical motives to well-meaning advocates of academic freedom.

ACLU's Legislative Purpose Summary (Pp. 27-35). While the ACLU Memorandum argues that "both statutes include the identical operative language" in Arkansas and Louisiana (p. 26), it fails to point out that the faulty language that was the focus of the McLean decision was immediately dropped in Louisiana (as discussed above), and that the actual text of the statutes differs in most paragraphs (as shown in the comparison in Exhibits VI and VII). The first Keith bill was not an "early draft" of what became Act 685 (p. 28), but was a very different proposal, and its language that the ACLU quotes was immediately rejected by the Legislature. In referring to "creation by

God" (p. 29), the ACLU places words in the mouth of the Louisiana Legislature and Sen. Keith that were not uttered in the legislative history in defining creation-science. Although the concept of creation "ex nihilo" was rejected by the Louisiana Legislature (p. 29), it is not an inherently religious concept (as discussed earlier166lv/). Although Mr. Ellwanger indeed did make some statements of his personal religious beliefs, the ACLU omits to identify him as a Roman Catholic who not only was not a Fundamentalist but very much opposed Fundamentalism (as quoted above). In citing Sen. Keith's account of his son being threatened in public schools for stating that "God created the world and God created man" (p. 31), the ACLU falsely gives the impression that that was Sen. Keith's definition of

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166lv. Note 57 supra.

creation-science, when in fact he was merely citing the factual incident of discrimination against his son, without making any such equation. While the ACLU argues that a "religiously-motivated intent to prevent the teaching of the theory of evolution" was manifested (p. 32), its citations to Dr. Harlow and Sen. Keith are out of context and it misinterprets the statement by Mr. Ward (as discussed above), as well as ignoring the larger context of these three gentlemen affirmatively seeking balanced treatment of evolution and creation-science both. These were three isolated statements about the teaching of evolution itself, and were not repeated or paralleled by other witnesses or legislators.

It is interesting to note that the ACLU cites Lynch v. Donnelly on disregarding the legislative purpose (pp. 34, 21), but not on its main holdings. Those are

that only an exclusively religious legislative purpose will strike down a statute under that aspect of the establishment clause test, that public schools may constitutionally refer to "God," that alternate tests besides the tripart test may be used under the Establishment Clause, and that a city's inclusion of a nativity scene in its Christmas display was constitutional and did not have an impermissible legislative purpose or effect (as further discussed below).

In conclusion, the legislative history reflects a clear legislative purpose to advance academic freedom with added scientific information, and constantly and consistently negates any legislative purpose to advance religion.

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H. JUDGMENT, ORDER, OR DECISION IN QUESTION (R.564)

No. 85-1513

IN THE
SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1985

EDWIN W. EDWARDS, in his Official Capacity as Governor of Louisiana, WILLIAM J. GUSTE, JR., in his Official Capacity as Attorney General of Louisiana, LOUISIANA DEPARTMENT OF EDUCATION, and THOMAS G. CLAUSEN, in his Official Capacity as Superintendent of Education of Louisiana,

Appellants,

v.

DON AGUILLARD et al.,

Appellees.

ON APPEAL FROM THE
UNITED STATES COURT OF APPEALS FOR THE
FIFTH CIRCUIT

The following opinions are printed in the Jurisdictional Statement at the following pages:

Opinions of U.S. Court of Appeals for the Fifth Circuit En Banc (Dec. 12, 1985) A-1

Opinion of U.S. Court of Appeals for the Fifth Circuit (Panel) (July 8, 1985) A-7

The following opinion is printed in the Supplemental Appendix to the Jurisdictional Statement:

Opinion of U.S. District Court for the Eastern District of Louisiana (Jan. 10, 1985) B-1

CERTIFICATE OF SERVICE

I hereby certify, as a member of the ber of the Supreme Court of the United States, that on this day of August 1986, three copies of the joint appendix were served by mail, with the envelope duly addressed and with postage prepaid, to the attorneys of record for all other parties of record, except if multiple copies were waived thereby, as follows:

Samuel I. Rosenberg, Esq.
Polack, Rosenberg, Rittenberg & Endom
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I further certify that service is not required on any other persons, and that all parties required to be served have been served.

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